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NAS PENSACOLA  
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FINAL REMEDIAL INVESTIGATION REPORT VOLUME 2 OF 3 SITE 41 WETLANDS NAS  
PENSACOLA FL  
8/31/2000  
ENSAFE, INC

**FINAL REMEDIAL INVESTIGATION REPORT  
SITE 41, NAS PENSACOLA WETLANDS  
NAVAL AIR STATION  
PENSACOLA, FLORIDA**



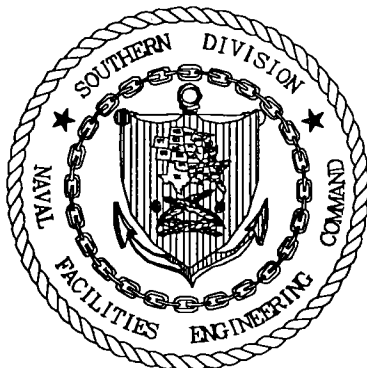
**SOUTHNAVFACENGCOM  
CONTRACT NUMBER:  
N62467-89-D-0318**

**CTO-036**

**Volume II of III  
Sections 10 to 13**

**Prepared for:**

**Comprehensive Long-Term  
Environmental Action Navy  
Naval Air Station  
Pensacola, Florida**



**Prepared by:**

**EnSafe Inc.  
5724 Summer Trees Drive  
Memphis, Tennessee 38134  
(901) 372-7962**

**August 31, 2000**

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SITE 41, NAS PENSACOLA WETLANDS  
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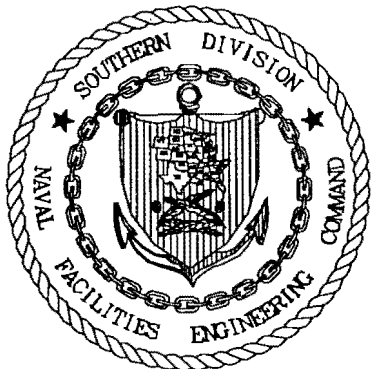
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## **10.0 SITE-SPECIFIC EVALUATIONS**

This section presents wetland-specific evaluations for nature and extent, fate and transport, and ecological and human health risk assessments. Methods used to perform the analysis are presented in Sections 5, 6, 7, 8, and 9. Conclusions and recommendations are presented in Section 11.

### **10.1 WETLAND 64**

#### **10.1.1 Site Description**

The Wetland 64 complex is an approximately 41 acre area located south of the boat docks on the western shore of the NAS Pensacola Yacht Basin. For the Site 41 RI, the Wetland 64 investigation incorporated several areas surrounding the NAS Pensacola Yacht Basin, to include Wetland 64 on the southeast shore of the Yacht Basin, the open water area of the Yacht Basin, and Wetlands 7 and 8. Wetland 7 encompasses the downstream end of the tile-lined storm water conduit (Wetland 6) that drains into the Yacht Basin. Wetland 8 includes the western shore of Magazine Point. Site 11 is adjacent the area of investigation to the southwest. Sites 12 and 26 are nearby, also to the southwest. Sites 32, 33, and 35 (Operable Unit [OU] 10) are southeast, on Magazine Point. The western shore of the Yacht Basin is also home to the NAS Pensacola Yacht Club. A concrete seawall exists along this portion of the shoreline, from which several docks extend into the Yacht Basin. Numerous boats are docked in this area. The western shore of the Yacht Basin also contains buildings, a paved parking area, a fenced area for boat storage, and road access. The eastern bank of the Yacht Basin remains relatively undisturbed.

The open water portion of the Wetland 64 complex is approximately 20 acres in size ranges from about 2 to 15 feet in depth, and 600 to 900 feet wide. Sediment in this area is highly organic, with TOC levels detected up to 20%. The dominant foliage of wetland areas along the banks of this complex is black needlerush (*Juncus roemerianus*). Wetland 6 drains storm water runoff from the



former Chevalier Field area, where the Naval Air Technical Training Center (NATTC) is currently located, along with the area surrounding the NAS Chapel.

Wetland 64 is of concern because it is close to Sites 11, 12, and 26, and the drainage pathway of Wetland 6 passes several other IR sites before reaching Wetland 64.

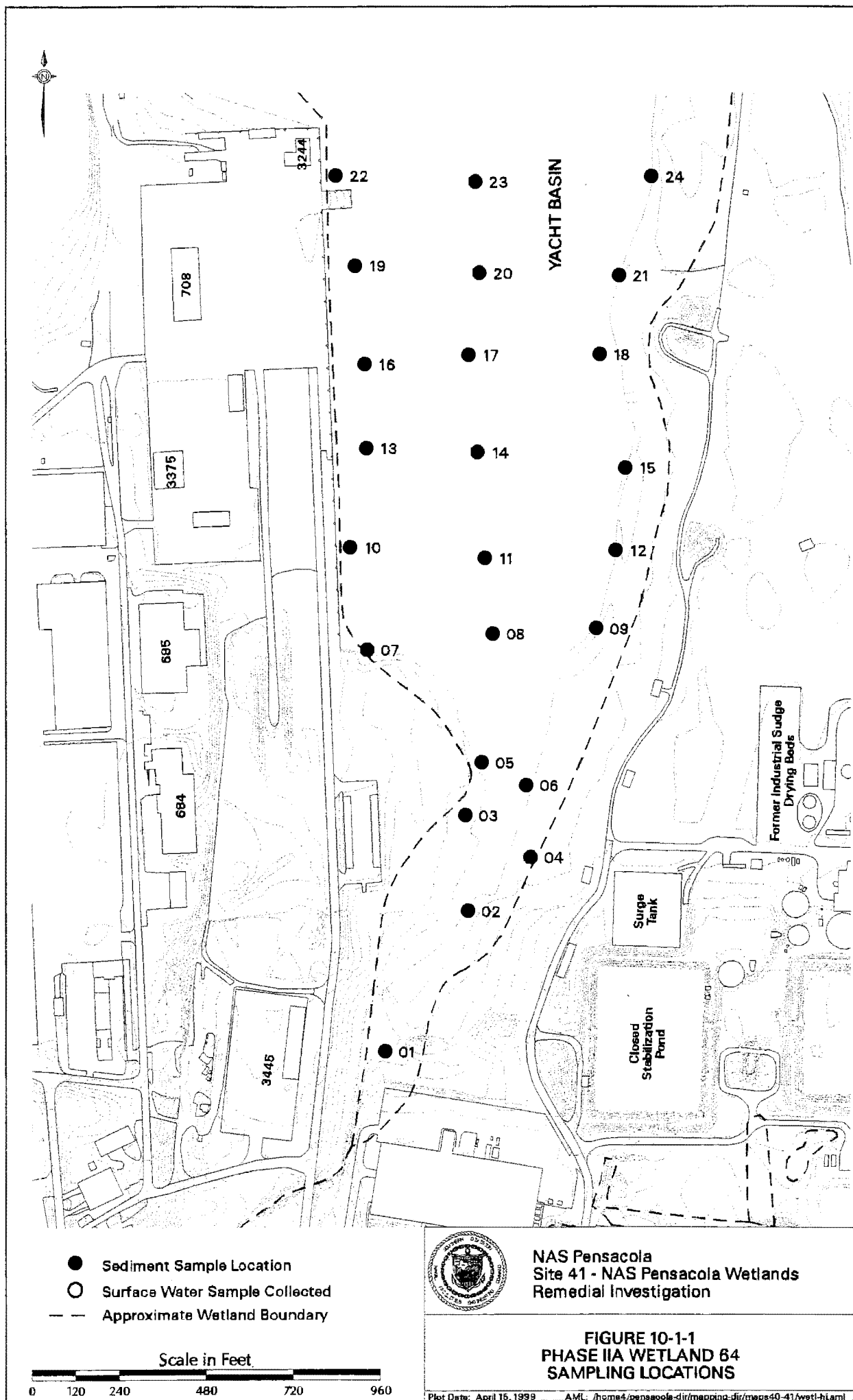
IR sites potentially affecting Wetland 64 include Sites 11, 12, 26, 32, 33, and 35. From the late 1930s until the early 1950s industrial waste was disposed of and burned at Site 11 (North Chevalier Disposal Site). Site 12 (Scrap Bins) was active from the early 1930s through the 1940s, as an area where wet garbage was deposited in receptacles. Site 26 (Supply Department Outside Storage) was a storage area for industrial chemicals from before 1956 until 1964 (NEESA, 1983). Sites 32, 33, and 35 (OU 10) include the former industrial waste sludge drying beds, the wastewater treatment plant ponds, and various solid waste management units of the former Industrial Wastewater Treatment Plant (IWTP) (NEESA, 1983). Metals, volatile organic compounds, and base/neutral and acid extractable compounds have been detected at OU 10. Because of the closure of industrial operations at NAS Pensacola during BRAC, the wastewater treatment plant changed from industrial to domestic operations in 1998.

#### **10.1.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-1-1 denotes the Phase IIA Wetland 64 sampling locations.

#### **Sediment**

Twenty-three metals were detected in Wetland 64 sediment samples. Nine of these — arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc — exceeded sediment benchmark levels. Seven arsenic exceedances ranged from 9.8 ppm to 17 ppm. Fourteen cadmium exceedances ranged from 1.6 ppm to 38.6 ppm. Twelve chromium exceedances ranged from 78.2 ppm to 1,610 ppm. Eleven copper exceedances ranged from 29.4 ppm to 255 ppm. Fourteen lead exceedances ranged from 31.9 ppm to 634 ppm.



Twelve mercury exceedances ranged from 0.15 ppm to 0.88 ppm. Three nickel exceedances ranged from 18.6 ppm to 27.1 ppm. One silver exceedance occurred at sample location 6403 (5.1 ppm). Nine zinc exceedances ranged from 145 ppm to 481 ppm. Fourteen pesticides were detected in Wetland 64 sediment samples, including DDT and its metabolites, aldrin, dieldrin, endosulfan I/II, endrin/endrin aldehyde, heptachlor, alpha/gamma-BHC, and alpha/gamma-chlordane. Only one 4,4'-DDD sample (140 ppb at location 6402), and two 4,4'-DDE samples (72 ppb and 78 ppb at locations 6402 and 6403) exceeded basewide levels for these parameters. Other pesticides exceeding appropriate sediment benchmark criteria included dieldrin, endrin, gamma-BHC and alpha/gamma-chlordane. At locations 6402 and 6403, alpha-chlordane (7.1 ppb and 10 ppb) and gamma-chlordane (3.7 ppb and 8.5 ppb) exceeded benchmark levels. Five dieldrin exceedances ranged from 0.79 ppb to 3.3 ppb. Three endrin exceedances ranged from 3.8 ppb to 8.0 ppb. A single gamma-BHC concentration at location 6404 (1.6 ppb) exceeded its benchmark level. Two PCBs were detected in Wetland 64 sediment samples, including Aroclors 1254 and 1260. Five Aroclor 1254 exceedances ranged from 29 ppb to 370 ppb, while four Aroclor 1260 exceedances ranged from 23 ppb to 50 ppb. Twenty-seven SVOCs were detected, many of which were high- and low-molecular weight PAHs. Twelve PAHs exceeded sediment benchmark levels: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene.

At locations 6401 and 6405, acenaphthene (120 ppb and 230 ppb) and anthracene (230 ppb and 330 ppb) exceeded sediment benchmark levels. Acenaphthylene also exceeded its benchmark level at location 6405 (90 ppb). Nine benzo(a)anthracene exceedances ranged from 120 ppb to 1,400 ppb. Nine benzo(a)pyrene exceedances ranged from 120 ppb to 910 ppb. Nine chrysene exceedances ranged from 130 ppb to 1,500 ppb. A single dibenz(a,h)anthracene exceedance occurred at location 6401 (25 ppb). Thirteen fluoranthene exceedances ranged from 120 ppb to 5,700 ppb. At locations 6401 and 6405, fluorene (160 ppb and 210 ppb) and naphthalene

(56 ppb and 71 ppb) exceeded benchmark levels. Nine phenanthrene exceedances ranged from 100 ppb to 2,800 ppb. Eleven pyrene exceedances ranged from 190 ppb to 4,600 ppb. The phthalate ester bis(2-ethylhexyl)phthalate was also detected above its benchmark level at location 6408 (220 ppb). The VOCs detected were acetone, carbon disulfide, chlorobenzene, and methylene chloride. Acetone and methylene chloride are common laboratory contaminants.

Table 10-1-1 shows the Wetland 64 Phase IIA sediment sample results including the frequency of detection, range of detected concentrations, and average detected concentration. Table 10-1-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. An explanation of the HQ calculation is provided in Section 7. Only the detected parameters with benchmark levels are presented in Table 10-1-2. The HQs will be further discussed in the ecological risk section.

Table 10-1-1  
 Phase IIA Detected Concentrations in Wetland 64 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	24/24	28.9 - 26800	6455.18
Antimony (Sb)	4/10	0.19 - 10.8	3.07
Arsenic (As)	19/24	0.16 - 18.7	6.99
Barium (Ba)	22/24	0.35 - 1280	66.40
Beryllium (Be)	10/24	0.11 - 1.3	0.77
Cadmium (Cd)	22/24	0.19 - 38.6	9.46
Calcium (Ca)	22/24	64.4 - 6630	1996.31
Chromium (Cr)	24/24	0.55 - 1800	402.05
Cobalt (Co)	15/24	0.13 - 9.4	2.34
Copper (Cu)	22/24	0.74 - 255	41.25
Iron (Fe)	24/24	26 - 38200	10953.76
Lead (Pb)	23/24	0.65 - 634	137.38
Magnesium (Mg)	24/24	47.1 - 9390	2771.49
Manganese (Mn)	24/24	0.12 - 203	59.69
Mercury (Hg)	14/23	0.1 - 0.88	0.37

**Table 10-1-1**  
**Phase IIA Detected Concentrations in Wetland 64 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
Nickel (Ni)	17/23	0.79 - 27.1	9.04
Potassium (K)	24/24	19.9 - 4520	940.13
Selenium (Se)	11/24	0.34 - 3.1	1.48
Silver (Ag)	4/22	0.37 - 5.1	1.65
Sodium (Na)	23/24	43.8 - 30200	8748.51
Thallium (Tl)	2/22	0.65 - 1.2	0.93
Vanadium (V)	22/24	0.42 - 60.7	14.47
Zinc (Zn)	23/24	2.2 - 481	127.91
<b>Pesticides and PCBs (<math>\mu\text{g/kg}</math>)</b>			
4,4'-DDD	14/24	0.2 - 140	20.71
4,4'-DDE	14/24	0.35 - 78	16.12
4,4'-DDT	6/24	0.6 - 14	5.23
Aldrin	6/24	0.17 - 4	1.59
Aroclor-1254	8/24	1.3 - 370	80.45
Aroclor-1260	12/24	1.3 - 50	18
Dieldrin	5/24	0.79 - 3.3	1.74
Endosulfan I	1/24	0.76	0.76
Endosulfan II	1/24	1.7	1.7
Endrin	5/24	0.46 - 8	3.81
Endrin aldehyde	1/24	0.29	0.29
Heptachlor	1/24	0.12	0.12
alpha-BHC	9/24	0.12 - 0.94	0.43
alpha-Chlordane	4/24	0.28 - 10	4.47
gamma-BHC (Lindane)	5/24	0.13 - 1.6	0.49
gamma-Chlordane	5/24	0.65 - 8.5	2.95
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
1,2-Dichlorobenzene	1/24	190	190
1,4-Dichlorobenzene	2/24	70 - 260	165
2-Methylnaphthalene	1/24	30	30
Acenaphthene	2/24	120 - 230	175
Acenaphthylene	1/24	90	90
Anthracene	2/24	230 - 330	280
Benzo(a)anthracene	12/24	27 - 1400	358

Remedial Investigation  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-1-1  
 Phase IIA Detected Concentrations in Wetland 64 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
Benzo(a)pyrene	13/24	25 - 910	259.31
Benzo(b)fluoranthene	16/24	21 - 2600	531.94
Benzo(g,h,i)perylene	9/24	29 - 590	207.33
Benzo(k)fluoranthene	7/24	35 - 250	176.43
Burylbenzylphthalate	8/24	28 - 280	142.13
Carbazole	2/24	230 - 400	315
Chrysene	13/24	23 - 1500	368.08
Di-n-butylphthalate	9/24	28 - 430	156.22
Dibenz(a,h)anthracene	1/24	25	25
Dibenzofuran	2/24	72 - 85	78.5
Diethylphthalate	3/24	80 - 2000	996.67
Dimethyl phthalate	1/24	510	510
Fluoranthene	19/24	24 - 5700	782.16
Fluorene	2/24	160 - 210	185
Indeno(1,2,3-cd)pyrene	8/24	39 - 600	232.38
Naphthalene	2/24	56 - 71	63.5
Phenanthrene	12/24	42 - 2800	539.83
Phenol	1/24	220	220
Pyrene	19/24	22 - 4600	667.95
bis(2-Ethylhexyl)phthalate (BEHP)	3/24	33 - 530	261
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
Acetone	10/24	9 - 420	152.3
Carbon disulfide	1/24	11	11
Chlorobenzene	1/24	48	48
Methylene chloride	5/24	64 - 400	183.2

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results were rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion, except for metals which are in milligrams per kilogram ( $\text{mg/kg}$ ) or parts per million.

Table 10-1-2 (1)

## Wetland 64

## Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M640201</b>					
	4,4'-DDD (UG/KG)	140	1.22	114.75	b
	4,4'-DDE (UG/KG)	72	2.07	34.78	b
	alpha-Chlordane (UG/KG)	7.1	1.7	4.18	a
	Antimony (MG/KG)	0.33	12	0.03	a
	Aroclor-1254 (UG/KG)	370	21.6	17.13	b
	Arsenic (MG/KG)	9.8	7.24	1.35	a,b
	Benzo(a)anthracene (UG/KG)	1400	74.8	18.72	b
	Cadmium (MG/KG)	18.9	0.68	27.79	b
	Chromium (MG/KG)	1600	52.3	30.59	a,b
	Chrysene (UG/KG)	1500	105	13.89	b
	Copper (MG/KG)	39.8	18.7	2.13	a,b
	Dieldrin (UG/KG)	3.3	0.72	4.58	b
	Endrin (UG/KG)	3.8	3.3	1.15	a
	Fluoranthene (UG/KG)	5700	113	50.44	b
	gamma-Chlordane (UG/KG)	3.7	1.7	2.18	a

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

**Table 10-1-2 (2)**  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Lead (MG/KG)	348	30.2	11.46	a b
	Mercury (MG/KG)	0.17	0.13	1.31	a b
	Nickel (MG/KG)	4.6	15.9	0.29	a b
	Phenanthrene (UG/KG)	2800	86.7	32.30	b
	Pyrene (UG/KG)	4600	153	30.07	b
	Silver (MG/KG)	0.42	0.73	0.58	b
	Zinc (MG/KG)	146	124	1.17	a b

041M64001	4,4'-DDT (UG/KG)	18	1.22	13.11	b
	4,4'-DDE (UG/KG)	18	2.07	8.70	b
	Antimony (MG/KG)	10.8	12	0.90	a
	Aroclor-1260 (UG/KG)	23	21.6	1.06	b
	Arsenic (MG/KG)	3	7.24	0.41	a b
	Cadmium (MG/KG)	2.8	0.68	4.12	b
	Chromium (MG/KG)	1610	52.3	30.78	a b
	Copper (MG/KG)	23.8	18.7	1.27	a b
	Endrin (UG/KG)	6.5	3.3	1.67	a
	Fluoranthene (UG/KG)	230	113	2.04	b
	gamma-BHC (Lindane) (UG/KG)	1.6	0.32	5.00	b

**041M64001**

4,4'-DDT (UG/KG)	18	1.22	13.11	b
4,4'-DDE (UG/KG)	18	2.07	8.70	b
Antimony (MG/KG)	10.8	12	0.90	a
Aroclor-1260 (UG/KG)	23	21.6	1.06	b
Arsenic (MG/KG)	3	7.24	0.41	a b
Cadmium (MG/KG)	2.8	0.68	4.12	b
Chromium (MG/KG)	1610	52.3	30.78	a b
Copper (MG/KG)	23.8	18.7	1.27	a b
Endrin (UG/KG)	6.5	3.3	1.67	a
Fluoranthene (UG/KG)	230	113	2.04	b
gamma-BHC (Lindane) (UG/KG)	1.6	0.32	5.00	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.



Table 10-1-2(3)  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Lead (MG/KG)	146	30.2	4.83	a b
	Mercury (MG/KG)	0.43	0.13	3.31	a b
	Nickel (MG/KG)	5.3	15.9	0.33	a b
	Pyrene (UG/KG)	200	153	1.31	b
	Zinc (MG/KG)	318	124	0.26	a b

4,4'-DDT (UG/KG)	30	1.22	24.59	b
4,4'-DDE (UG/KG)	16	2.07	7.73	b
4,4'-DDT (UG/KG)	1.4	1.19	1.18	b
Aroclor-1260 (UG/KG)	56	21.6	2.59	b
Arsenic (MG/KG)	1.6	7.24	0.22	a b
Cadmium (MG/KG)	8.8	0.68	12.94	b
Chromium (MG/KG)	324	62.3	5.20	a b

**D41M640601**

4,4'-DDD (UG/KG)	30	1.22	24.59	b
4,4'-DDE (UG/KG)	16	2.07	7.73	b
4,4'-DDT (UG/KG)	1.4	1.19	1.18	b
Aroclor-1260 (UG/KG)	56	21.6	2.59	b
Arsenic (MG/KG)	1.6	7.24	0.22	a b
Cadmium (MG/KG)	8.8	0.68	12.94	b
Chromium (MG/KG)	324	62.3	5.20	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

**Table 10-1-2 (4)**  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Copper (MG/KG)	29.4	18.7	1.57	a b
	Fluoranthene (UG/KG)	1700	113	15.04	b
	gamma-Chlordane (UG/KG)	0.81	1.7	0.48	a
	Lead (MG/KG)	156	39.2	5.17	a b
	Mercury (MG/KG)	0.12	0.13	0.92	a b
	Nickel (MG/KG)	3	15.9	0.19	a b
	Pyrene (UG/KG)	1500	153	9.80	b
	Silver (MG/KG)	0.37	0.73	0.51	b
	Zinc (MG/KG)	105	124	0.85	a b

041M640801	4,4'-DDD (UG/KG)	2.2	1.22	1.80	b
	4,4'-DDE (UG/KG)	2.4	2.07	1.16	b
	4,4'-DDT (UG/KG)	0.66	1.19	0.55	b
	alpha-Chlordane (UG/KG)	0.28	1.7	0.16	a
	Aroclor-1260 (UG/KG)	11	21.8	0.51	b
	Arsenic (MG/KG)	0.59	7.24	0.08	a b
	Benzo(a)anthracene (UG/KG)	51	74.8	0.68	b
	Benzo(a)pyrene (UG/KG)	51	88.8	0.57	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	220	182	1.21	b
	Cadmium (MG/KG)	1.2	0.68	1.76	b
	Chromium (MG/KG)	32.3	52.3	0.62	a b
	Chrysene (UG/KG)	61	108	0.56	b
	Copper (MG/KG)	6.9	18.7	0.37	a b

**041M640801**

4,4'-DDD (UG/KG)	2.2	1.22	1.80	b
4,4'-DDE (UG/KG)	2.4	2.07	1.16	b
4,4'-DDT (UG/KG)	0.66	1.19	0.55	b
alpha-Chlordane (UG/KG)	0.28	1.7	0.16	a
Aroclor-1260 (UG/KG)	11	21.8	0.51	b
Arsenic (MG/KG)	0.59	7.24	0.08	a b
Benzo(a)anthracene (UG/KG)	51	74.8	0.68	b
Benzo(a)pyrene (UG/KG)	51	88.8	0.57	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	220	182	1.21	b
Cadmium (MG/KG)	1.2	0.68	1.76	b
Chromium (MG/KG)	32.3	52.3	0.62	a b
Chrysene (UG/KG)	61	108	0.56	b
Copper (MG/KG)	6.9	18.7	0.37	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding.

Table 10-1-2 (5)  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Endrin (UG/KG)	0.46	3.3	0.14	a
	Endrin aldehyde (UG/KG)	0.29	3.3	0.09	a
	Fluoranthene (UG/KG)	120	113	1.06	b
	Lead (MG/KG)	17.6	30.2	0.58	a b
	Nickel (MG/KG)	0.79	15.9	0.05	a b
	Phenanthrene (UG/KG)	59	86.7	0.68	b
	Pyrene (UG/KG)	120	153	0.78	b
	Zinc (MG/KG)	21.1	124	0.17	a b

#### 041MG41001

4,4'-DDD (UG/KG)	1.8	1.22	1.80	b
4,4'-DDE (UG/KG)	2.5	2.07	1.21	b
Aroclor-1260 (UG/KG)	24	21.6	1.11	b
Arsenic (MG/KG)	16.2	7.24	2.24	a b
Benzo(a)anthracene (UG/KG)	240	74.8	3.21	b
Benzo(a)pyrene (UG/KG)	290	88.8	3.27	b
Cadmium (MG/KG)	23.2	0.68	34.12	b
Chromium (MG/KG)	806	52.3	15.41	a b
Chrysene (UG/KG)	320	108	2.96	b
Copper (MG/KG)	140	18.7	7.49	a b
Dieldrin (UG/KG)	1.3	0.72	2.08	b
Fluoranthene (UG/KG)	720	113	6.37	b
gamma-Chlordane (UG/KG)	0.65	1.7	0.38	a
Lead (MG/KG)	324	30.2	10.73	a b
Mercury (MG/KG)	0.5	0.13	3.65	a b
Nickel (MG/KG)	20.1	15.9	1.26	a b
Phenanthrene (UG/KG)	300	86.7	3.46	b
Pyrene (UG/KG)	590	153	3.86	b
Zinc (MG/KG)	377	124	3.04	a b

#### 041MG41001

4,4'-DDD (UG/KG)	2.2	1.22	1.80	b
4,4'-DDE (UG/KG)	2.5	2.07	1.21	b
Aroclor-1260 (UG/KG)	24	21.6	1.11	b
Arsenic (MG/KG)	16.2	7.24	2.24	a b
Benzo(a)anthracene (UG/KG)	240	74.8	3.21	b
Benzo(a)pyrene (UG/KG)	290	88.8	3.27	b
Cadmium (MG/KG)	23.2	0.68	34.12	b
Chromium (MG/KG)	806	52.3	15.41	a b
Chrysene (UG/KG)	320	108	2.96	b
Copper (MG/KG)	140	18.7	7.49	a b
Dieldrin (UG/KG)	1.3	0.72	2.08	b
Fluoranthene (UG/KG)	720	113	6.37	b
gamma-Chlordane (UG/KG)	0.65	1.7	0.38	a
Lead (MG/KG)	324	30.2	10.73	a b
Mercury (MG/KG)	0.5	0.13	3.65	a b
Nickel (MG/KG)	20.1	15.9	1.26	a b
Phenanthrene (UG/KG)	300	86.7	3.46	b
Pyrene (UG/KG)	590	153	3.86	b
Zinc (MG/KG)	377	124	3.04	a b

#### 041MG41001

#### Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

Table 10-1-2 (6)  
Wetland 64  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
10000	Asbestos	0.00	0.00	0.00	0
10000	Barium	0.00	0.00	0.00	0
10000	Beryllium	0.00	0.00	0.00	0
10000	Bismuth	0.00	0.00	0.00	0
10000	Boron	0.00	0.00	0.00	0
10000	Bromine	0.00	0.00	0.00	0
10000	Cadmium	0.00	0.00	0.00	0
10000	Calcium	0.00	0.00	0.00	0
10000	Chromium	0.00	0.00	0.00	0
10000	Copper	0.00	0.00	0.00	0
10000	Fluorine	0.00	0.00	0.00	0
10000	Gold	0.00	0.00	0.00	0
10000	Iron	0.00	0.00	0.00	0
10000	Lead	0.00	0.00	0.00	0
10000	Manganese	0.00	0.00	0.00	0
10000	Mercury	0.00	0.00	0.00	0
10000	Molybdenum	0.00	0.00	0.00	0
10000	Nickel	0.00	0.00	0.00	0
10000	Phosphorus	0.00	0.00	0.00	0
10000	Potassium	0.00	0.00	0.00	0
10000	Selenium	0.00	0.00	0.00	0
10000	Silver	0.00	0.00	0.00	0
10000	Sulfur	0.00	0.00	0.00	0
10000	Titanium	0.00	0.00	0.00	0
10000	Zinc	0.00	0.00	0.00	0

041M641201

4,4-DDD (UG/KG)	0.26	1.22	0.21	b
Aroclor-1254 (UG/KG)	1.7	21.6	0.08	b
Cadmium (MG/KG)	0.27	0.68	0.40	b
Chromium (MG/KG)	7.2	52.3	0.14	a b
Copper (MG/KG)	1.9	18.7	0.10	a b
gamma-BHC (Lindane) (UG/KG)	0.28	0.32	0.88	b
Lead (MG/KG)	3.6	30.2	0.12	a b
Zinc (MG/KG)	4.2	124	0.03	a b

Category	1990	1991	1992	1993	1994
1. Total	100	100	100	100	100
2. Manufacturing	45	45	45	45	45
3. Services	55	55	55	55	55
4. Government	10	10	10	10	10
5. Education	15	15	15	15	15
6. Health	10	10	10	10	10
7. Social Security	10	10	10	10	10
8. Unemployment Insurance	10	10	10	10	10
9. Medicare	10	10	10	10	10
10. Medicaid	10	10	10	10	10
11. Veterans Affairs	10	10	10	10	10
12. Housing	10	10	10	10	10
13. Transportation	10	10	10	10	10
14. Energy	10	10	10	10	10
15. Environment	10	10	10	10	10
16. Agriculture	10	10	10	10	10
17. Forestry	10	10	10	10	10
18. Fisheries	10	10	10	10	10
19. Mining	10	10	10	10	10
20. Other	10	10	10	10	10

### Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Table 10-1-2 (7)  
Wetland 64  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
Sample 100000		1.45	1.11	1.45	a
Sample 100001		1.13	1.11	1.13	a
Sample 100002		1.15	1.11	1.15	a
Sample 100003		1.13	1.11	1.13	a
Sample 100004		1.15	1.11	1.15	a

**041M641401**

Aroclor-1260 (UG/KG)	16	21.6	0.74	b
Arsenic (MG/KG)	16.1	7.24	2.22	a b
Benzo(a)pyrene (UG/KG)	120	88.8	1.35	b
Cadmium (MG/KG)	17.2	0.68	25.29	b
Chromium (MG/KG)	531	52.3	12.07	a b
Chrysene (UG/KG)	130	108	1.20	b
Copper (MG/KG)	83.9	18.7	4.49	a b
Fluoranthene (UG/KG)	250	113	2.21	b
Lead (MG/KG)	205	30.2	6.79	a b
Mercury (MG/KG)	0.41	0.13	3.15	a b
Nickel (MG/KG)	15.1	15.9	0.95	a b
Pyrene (UG/KG)	190	153	1.24	b
Zinc (MG/KG)	250	124	2.10	a b

Sample 100005		1.45	1.11	1.45	a
Sample 100006		1.13	1.11	1.13	a
Sample 100007		1.15	1.11	1.15	a
Sample 100008		1.13	1.11	1.13	a
Sample 100009		1.15	1.11	1.15	a
Sample 100010		1.13	1.11	1.13	a
Sample 100011		1.15	1.11	1.15	a
Sample 100012		1.13	1.11	1.13	a
Sample 100013		1.15	1.11	1.15	a
Sample 100014		1.13	1.11	1.13	a
Sample 100015		1.15	1.11	1.15	a
Sample 100016		1.13	1.11	1.13	a
Sample 100017		1.15	1.11	1.15	a
Sample 100018		1.13	1.11	1.13	a
Sample 100019		1.15	1.11	1.15	a
Sample 100020		1.13	1.11	1.13	a
Sample 100021		1.15	1.11	1.15	a
Sample 100022		1.13	1.11	1.13	a
Sample 100023		1.15	1.11	1.15	a
Sample 100024		1.13	1.11	1.13	a
Sample 100025		1.15	1.11	1.15	a
Sample 100026		1.13	1.11	1.13	a
Sample 100027		1.15	1.11	1.15	a
Sample 100028		1.13	1.11	1.13	a
Sample 100029		1.15	1.11	1.15	a
Sample 100030		1.13	1.11	1.13	a
Sample 100031		1.15	1.11	1.15	a
Sample 100032		1.13	1.11	1.13	a
Sample 100033		1.15	1.11	1.15	a
Sample 100034		1.13	1.11	1.13	a
Sample 100035		1.15	1.11	1.15	a
Sample 100036		1.13	1.11	1.13	a
Sample 100037		1.15	1.11	1.15	a
Sample 100038		1.13	1.11	1.13	a
Sample 100039		1.15	1.11	1.15	a
Sample 100040		1.13	1.11	1.13	a
Sample 100041		1.15	1.11	1.15	a
Sample 100042		1.13	1.11	1.13	a
Sample 100043		1.15	1.11	1.15	a
Sample 100044		1.13	1.11	1.13	a
Sample 100045		1.15	1.11	1.15	a
Sample 100046		1.13	1.11	1.13	a
Sample 100047		1.15	1.11	1.15	a
Sample 100048		1.13	1.11	1.13	a
Sample 100049		1.15	1.11	1.15	a
Sample 100050		1.13	1.11	1.13	a
Sample 100051		1.15	1.11	1.15	a
Sample 100052		1.13	1.11	1.13	a
Sample 100053		1.15	1.11	1.15	a
Sample 100054		1.13	1.11	1.13	a
Sample 100055		1.15	1.11	1.15	a
Sample 100056		1.13	1.11	1.13	a
Sample 100057		1.15	1.11	1.15	a
Sample 100058		1.13	1.11	1.13	a
Sample 100059		1.15	1.11	1.15	a
Sample 100060		1.13	1.11	1.13	a
Sample 100061		1.15	1.11	1.15	a
Sample 100062		1.13	1.11	1.13	a
Sample 100063		1.15	1.11	1.15	a
Sample 100064		1.13	1.11	1.13	a
Sample 100065		1.15	1.11	1.15	a
Sample 100066		1.13	1.11	1.13	a
Sample 100067		1.15	1.11	1.15	a
Sample 100068		1.13	1.11	1.13	a
Sample 100069		1.15	1.11	1.15	a
Sample 100070		1.13	1.11	1.13	a
Sample 100071		1.15	1.11	1.15	a
Sample 100072		1.13	1.11	1.13	a
Sample 100073		1.15	1.11	1.15	a
Sample 100074		1.13	1.11	1.13	a
Sample 100075		1.15	1.11	1.15	a
Sample 100076		1.13	1.11	1.13	a
Sample 100077		1.15	1.11	1.15	a
Sample 100078		1.13	1.11	1.13	a
Sample 100079		1.15	1.11	1.15	a
Sample 100080		1.13	1.11	1.13	a
Sample 100081		1.15	1.11	1.15	a
Sample 100082		1.13	1.11	1.13	a
Sample 100083		1.15	1.11	1.15	a
Sample 100084		1.13	1.11	1.13	a
Sample 100085		1.15	1.11	1.15	a
Sample 100086		1.13	1.11	1.13	a
Sample 100087		1.15	1.11	1.15	a
Sample 100088		1.13	1.11	1.13	a
Sample 100089		1.15	1.11	1.15	a
Sample 100090		1.13	1.11	1.13	a
Sample 100091		1.15	1.11	1.15	a
Sample 100092		1.13	1.11	1.13	a
Sample 100093		1.15	1.11	1.15	a
Sample 100094		1.13	1.11	1.13	a
Sample 100095		1.15	1.11	1.15	a
Sample 100096		1.13	1.11	1.13	a
Sample 100097		1.15	1.11	1.15	a
Sample 100098		1.13	1.11	1.13	a
Sample 100099		1.15	1.11	1.15	a
Sample 100100		1.13	1.11	1.13	a

**041M641601**

Aroclor-1260 (UG/KG)	16	21.6	0.74	b
Arsenic (MG/KG)	18.7	7.24	2.58	a b
Benzo(a)anthracene (UG/KG)	120	74.8	1.60	b
Benzo(a)pyrene (UG/KG)	140	88.8	1.58	b
Cadmium (MG/KG)	19	0.68	27.94	b
Chromium (MG/KG)	758	52.3	14.46	a b

Notes:  
(a) USEPA Screening Concentration for Sediment - EPA SSVs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding.

**Table 10-1-2 (8)**  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Chrysene (UG/KG)	150	108	1.48	b
	Copper (MG/KG)	119	18.7	6.36	a b
	Fluoranthene (UG/KG)	330	113	2.92	b
	Lead (MG/KG)	249	30.2	8.25	a b
	Mercury (MG/KG)	0.49	0.13	3.77	a b
	Nickel (MG/KG)	18.6	16.9	1.12	a b
	Phenanthrene (UG/KG)	140	86.7	1.61	b
	Pyrene (UG/KG)	250	163	1.63	b
	Zinc (MG/KG)	300	124	2.42	a b

<b>041M641701</b>					
	Acetaminophen	48	1.1	43.6	b
	Acetone	33	1.1	30.0	a b
	Acrylonitrile	40	1.1	36.0	b
	Carbon tetrachloride	28	1.1	25.0	b
	Chlorobenzene	8.2	1.1	7.1	a b
	Chloroethane	8.1	1.1	7.0	a b
	Chloroform	41	1.1	37.0	b
	Diethyl ether	108	1.1	97.0	a b
	Diethylamine	11	1.1	10.0	b
	Diethylamine	11	1.1	10.0	b
	Diethylamine	11	1.1	10.0	b

**041M641801**

Aroclor-1280 (UG/KG)	1.3	21.6	0.06	b
Arsenic (MG/KG)	0.19	7.24	0.03	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	33	182	0.18	b
Cadmium (MG/KG)	0.19	0.88	0.28	b
Chromium (MG/KG)	5.2	52.3	0.10	a b
gamma-BHC (Lindane) (UG/KG)	0.18	0.32	0.56	b
Lead (MG/KG)	2.6	30.2	0.09	a b
Zinc (MG/KG)	2.6	124	0.02	a b

<b>041M641901</b>					
	Acetaminophen	1.1	1.1	1.0	b
	Acetone	1.1	1.1	1.0	b
	Acrylonitrile	1.1	1.1	1.0	b
	Carbon tetrachloride	1.1	1.1	1.0	b
	Chlorobenzene	1.1	1.1	1.0	b
	Chloroethane	1.1	1.1	1.0	b
	Chloroform	1.1	1.1	1.0	b
	Diethyl ether	1.1	1.1	1.0	b
	Diethylamine	1.1	1.1	1.0	b
	Diethylamine	1.1	1.1	1.0	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.



Table 10-1-2 (9)  
Wetland 84  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
Station 1000	Lead (ppm)	150	150	1.0	0.0
Station 1000	Copper (ppm)	10	10	1.0	0.0
Station 1000	Zinc (ppm)	100	100	1.0	0.0
Station 1000	Iron (ppm)	1000	1000	1.0	0.0
Station 1000	Aluminum (ppm)	1000	1000	1.0	0.0
Station 1000	Chromium (ppm)	10	10	1.0	0.0
Station 1000	Manganese (ppm)	10	10	1.0	0.0
Station 1000	Nickel (ppm)	10	10	1.0	0.0
Station 1000	Silver (ppm)	10	10	1.0	0.0
Station 1000	Mercury (ppm)	10	10	1.0	0.0
Station 1000	Fluoride (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10	10	1.0	0.0
Station 1000	Potassium (ppm)	10	10	1.0	0.0
Station 1000	Ammonium (ppm)	10	10	1.0	0.0
Station 1000	Nitrate (ppm)	10	10	1.0	0.0
Station 1000	Phosphate (ppm)	10	10	1.0	0.0
Station 1000	Sulfate (ppm)	10	10	1.0	0.0
Station 1000	Chloride (ppm)	10	10	1.0	0.0
Station 1000	Calcium (ppm)	10	10	1.0	0.0
Station 1000	Magnesium (ppm)	10	10	1.0	0.0
Station 1000	Sodium (ppm)	10			

## 041M642001

Aroclor-1260 (UG/KG)	1.9	21.6	0.09	b
Arsenic (MG/KG)	0.8	7.24	0.11	a b
Cadmium (MG/KG)	0.56	0.68	0.82	b
Chromium (MG/KG)	13.8	52.3	0.26	a b
Copper (MG/KG)	4.3	18.7	0.23	a b
Fluoranthene (UG/KG)	24	113	0.21	b
Lead (MG/KG)	7.5	30.2	0.25	a b
Pyrene (UG/KG)	22	153	0.14	b
Zinc (MG/KG)	15.8	124	0.13	a b

## References

•••••

041M642201

Benzo(a)anthracene (UG/KG)	38	74.8	0.51	b
Benzo(a)pyrene (UG/KG)	25	88.8	0.28	b
Cadmium (MG/KG)	1.6	0.68	2.35	b
Chromium (MG/KG)	21.3	52.3	0.41	a b
Chrysene (UG/KG)	35	108	0.32	b
Copper (MG/KG)	7.2	18.7	0.39	a b
Fluoranthene (UG/KG)	92	113	0.81	b
Lead (MG/KG)	36.3	30.2	1.20	a b
Mercury (MG/KG)	0.15	0.13	1.15	a b
Nickel (MG/KG)	3.9	15.9	0.25	a b
Phenanthrene (UG/KG)	57	86.7	0.56	b
Pyrene (UG/KG)	68	153	0.44	b

### Notes

(a) USEPA Screening Concentration for Sediment: EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Table 10-1-2 (10)  
**Wetland 64**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Silver (MG/KG)	0.72	0.73	0.99	b
	Zinc (MG/KG)	21.3	124	0.17	a b
<b>041M642401</b>					
	Chromium (MG/KG)	0.55	52.3	0.01	a b
	Mercury (MG/KG)	0.3	0.13	2.31	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.



### 10.1.3 Fate and Transport

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data are lacking, the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-1-3 presents those contaminants present in sediment above their benchmark levels and their calculated SSLs.

Table 10-1-3  
Calculated Sediment Screening Values for Wetland 64

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Arsenic	50 <sup>b</sup>	29	146	18.7	NO
Cadmium	0.774 <sup>a, b</sup>	75	5.82	38.6	YES
Chromium	11 <sup>a, b</sup>	19	21	1,800	YES
Copper	7.8 <sup>a, b</sup>	430	336	255	NO
Lead	1.71 <sup>a, b</sup>	900	154	634	YES
Mercury	0.012 <sup>a, b</sup>	52	0.0626	0.66	YES
Nickel	104 <sup>a, b</sup>	65	677	27.1	NO
Zinc	70.2 <sup>a, b</sup>	62	436	481	YES
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	10.5 <sup>a</sup>	188000	1.97E+08	78	NO
4,4 DDD	0.0064 <sup>a</sup>	42000	2.69E+04	140	NO
4,4 DDT	0.001 <sup>a, b</sup>	110460	11,046	14	NO
Dieldrin	0.0019 <sup>a, b</sup>	898.8	170.77	3.3	NO
Endrin	0.0023 <sup>a, b</sup>	516.6	118.81	8	NO
Gamma BHC	0.08 <sup>a, b</sup>	44.94	361	1.6	NO

Table 10-1-3  
 Calculated Sediment Screening Values for Wetland 64

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
2-methylnaphthalene	NA	315	NA	30	NA
Anthracene	110,000 <sup>b</sup>	1239	1.36e+10	330	NO
Acenaphthylene	0.031 <sup>b</sup>	130.2	4.04e+02	90	NO
Total PCBs*	0.014 <sup>a, b</sup>	12978	1.82e+04	50	NO
Acenaphthene	17 <sup>a</sup>	297.36	5.06e+05	230	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	16716	5.18e+04	1,400	NO
Benzo(a)pyrene	0.031 <sup>b</sup>	42840	1.33e+05	910	NO
Chrysene	0.031 <sup>b</sup>	16716	5.18e+04	1,500	NO
Dibenz(a)anthracene	0.031 <sup>b</sup>	159600	4.95e+05	25	NO
Fluoranthene	39.8 <sup>a</sup>	4490	1.79e+07	5,700	NO
Napthalene	62 <sup>a</sup>	84	5.21e+05	71	NO
Phenanthrene	0.031 <sup>b</sup>	1260	3.91e+03	2,800	NO
Pyrene	11,000 <sup>b</sup>	4410	4.85e+09	4,600	NO
Bis(2-ethylhexyl)phthalate	0.3 <sup>a</sup>	634000	1.90e+07	530	NO

Notes:

\* = based on Aroclor-1260

Kd for organics calculated using foc of 0.042 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient

SSL = sediment screening level

DF = dilution factor

a = USEPA Freshwater Surface Water Chronic Screening Criteria (1995a).

b = FDEP Class III Water Quality Criteria(1996).

## Transport Into The Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 64 through this pathway:

- Storm water runoff and sediment entrainment from Sites 11, 32, 33, 35, 12, and 26, and the northern portions of Chevalier Field.
- Direct surface water drainage and sediment transport from Wetland 6 (which receives runoff from Sites 9, 29, and 34 and numerous storm water outfalls along Chevalier Field) and, during tidal fluctuations and storm surge from the Bayou Grande.
- Indirect surface water drainage from Wetland 5, which receives runoff from Sites 30, 25, 27, 10 and numerous storm water outfalls.

Sediment contamination above benchmark levels (see Table 10-1-3) validates the sediment transport pathway, and by inference, the surface water pathway. No surface water data are available to further validate this pathway.

#### *Groundwater Discharge Pathway*

Based on a potentiometric analysis, the following sources can contribute contamination to Wetland 64 through groundwater discharge:

- Discharge from Sites 12, 26, and 11 to the west and Sites 32, 33, 35 to the east. Wetland 64 is at the lower end and groundwater discharges to it. Contamination found in both areas validates this pathway.

#### **Transport Within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

Contamination within the wetland can be expected to migrate toward the Bayou, except during tidal fluctuations and storm surge which can create a temporary landward direction.

#### *Sediment Leaching to Surface Water Pathway*

Eight inorganics and 20 organics exceeded their respective SSVs, but only five inorganics exceeded their calculated SSLs (see Table 10-1-3). This accumulation of contaminants reflects the basin's role as a major estuarine depositional element for the NAS Pensacola peninsula. It is difficult to attribute individual contaminant groups to a particular source due to the myriad of sources and because influx from these sources has not been hydrologically or chemically defined. Cadmium, chromium, lead and zinc exceedances tended to occur on the western side of the wetland, and mercury exceedances were widespread. Although no surface water data are available, the presence of these inorganics above SSLs suggests the pathway is valid.

#### **Transport From the Wetland**

Surface water and sediment likely occurs from the wetland into Bayou Grande, thus the contaminated sediment is expected to be mobile.

#### **10.1.4 Ecological Risk Assessment**

HQs for Wetland 64 sediment samples are presented in Table 10-1-2. Wetland 64 was classified in Group A (see Section 7) and sampled in Phase IIB/III based on the Phase IIA data. The methods and rationale for the ecological risk assessment are presented in Section 7.

#### **Phase IIA**

Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for several metals. Seven arsenic detections had HQs above 1 ranging from 1.35 to 2.35. Fourteen cadmium detections with HQs greater than 1 ranged from 2.35 to 56.76. Twelve chromium detections had HQs above 1 ranging from 1.5 to 30.78. Eleven copper detections with HQs greater than 1 ranged from 1.57 to 13.64. Fourteen lead detections had HQs above 1 ranging from 1.06 to 20.99. Twelve mercury detections had HQs above 1 ranging from 1.15 to 6.77. Three nickel detections had HQs greater than 1 ranging from 1.17 to 1.70.

One silver detection had a HQ of 6.99 at sample location 6403. Nine zinc detections had HQs greater than 1 ranging from 1.17 to 3.88. Nine 4,4'-DDD detections had HQs above 1 ranging from 1.80 to 114.75. Eight 4,4'-DDE detections had HQs above 1 ranging from 1.21 to 37.68. Three 4,4'-DDT detections had HQs above 1 ranging from 1.18 to 11.76. At locations 6402 and 6403, alpha-chlordane (4.18 and 5.88) and gamma-chlordane (2.18 and 5.0) had HQs above 1. Five dieldrin detections had HQs greater than 1 ranging from 1.10 to 4.58. Three endrin detections had HQs above 1 ranging from 1.15 to 2.42. A single gamma-BHC concentration at location 6404 had a HQ above 1 (5.0). Five Aroclor 1254 detections had HQs above 1 ranging from 1.34 to 17.13, while four Aroclor 1260 detections had HQs ranging from 1.06 to 2.31. At locations 6401 and 6405, acenaphthene (17.88 and 34.28) and anthracene (4.90 and 7.04) had HQs greater than 1. Acenaphthylene also had a HQ above 1 at location 6405 (15.33). Nine benzo(a)anthracene detections had HQs above 1 ranging from 1.60 to 18.72. Nine benzo(a)pyrene detections had HQs greater than 1 ranging from 1.35 to 10.25. Nine chrysene detections had HQs above 1 ranging from 1.20 to 13.89. A single dibenz(a,h)anthracene detection had a HQ greater than 1 at location 6401 (4.02). Thirteen fluoranthene detections had HQs above 1 ranging from 1.06 to 50.44. At locations 6401 and 6405, fluorene (7.55 and 9.91) and naphthalene (1.62 and 2.05) had HQs above 1. Nine phenanthrene detections had HQs greater than 1 ranging from 1.15 to 32.30. Eleven pyrene detections had HQs above 1 ranging from 1.24 to 30.07. The phthalate ester bis(2-ethylhexyl)phthalate also had a HQ above 1 at location 6408 (1.21). HQs greater than one indicate a potential for excess risk.

### **Phase IIB/III**

Based on Phase IIA sampling results, wetlands were further subdivided into groups to facilitate further analysis: Wetland 64 was classified as the only Group A wetland because it is unique in that it receives runoff from a large area of the base and has high concentrations of several metals, PAHs, and pesticides. Color-codes, groupings and rationale for classification are described in

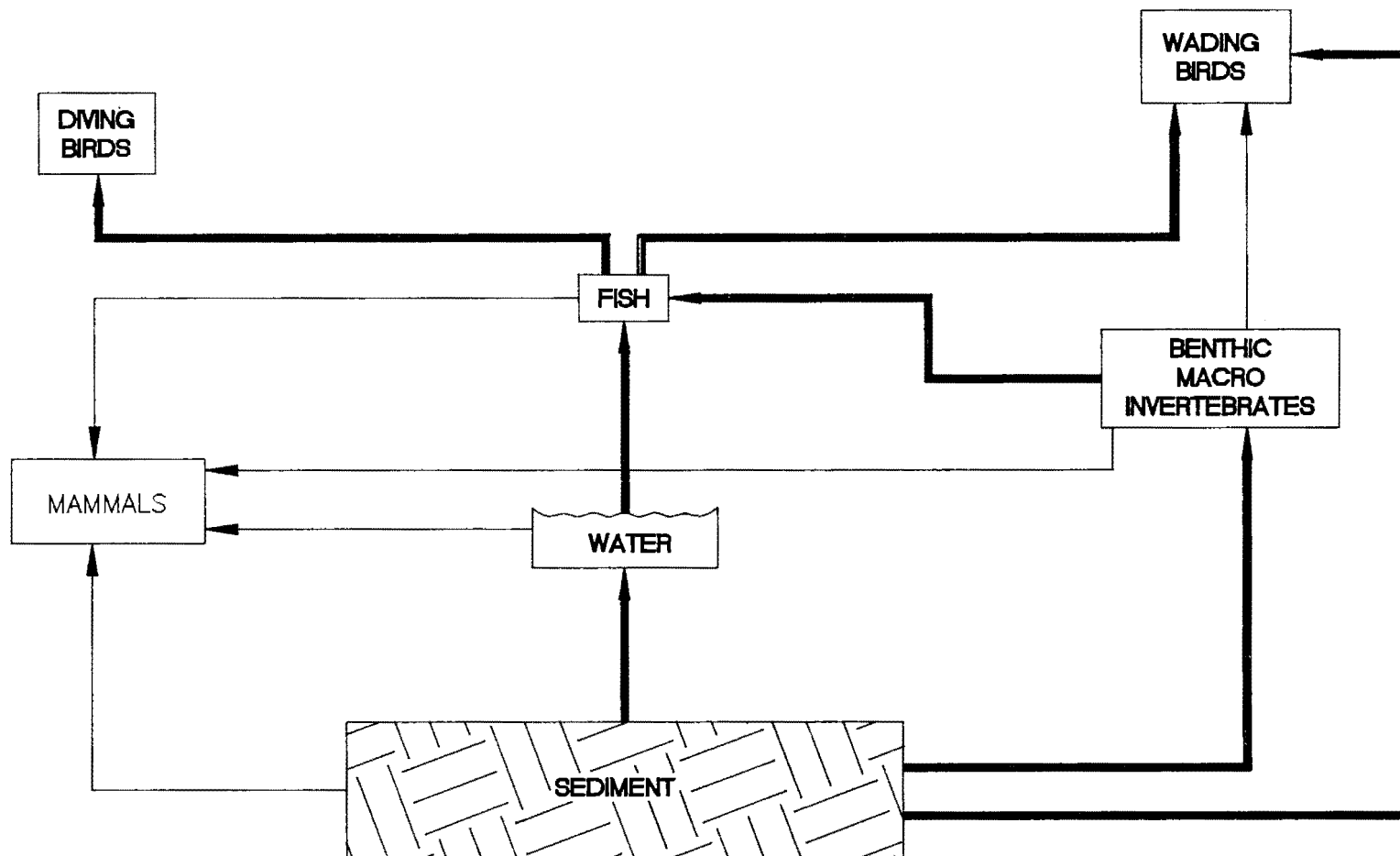
Section 7. The sediment in this wetland has high TOC values (up to 20%). Benthic macroinvertebrates are suspected to be prominent in this wetland, unlike most wetlands on base that have intermittent surface water levels.

### **Conceptual Model**

Conceptual models demonstrate contaminant interaction throughout the food chain and help in selecting receptor species, referred to as measurement and assessment endpoint species. Measurement endpoints, defined in Section 7.9, are used to quantify direct impacts on the species chosen in the conceptual model. Assessment endpoints, also defined in Section 7.9, predict impacts on similar species not directly measured in the model. The conceptual model developed for Wetland 64 is shown in Figure 10-1-2.

### **Sampling Location Rationale**

Phase IIB/III samples for sediment toxicity analysis, sediment chemistry, TOC, grain size, and benthic diversity were collected from Phase IIA sample locations 4, 5, and 6. These locations were selected because they represented a contaminant gradient in the upper reaches of the Yacht Basin. The remainder of the Yacht Basin was originally addressed under the Site 40 RI, but is now included in Site 41. The three composite grab samples for benthic diversity were collected within 10 feet of each sample location to account for spatial variability. For tissue residue analysis, fish were collected from sample locations 4 and 5 (composite sample location 1) and 6. Two discrete surface water samples were also collected for chemical analysis, one between locations 1 and 2 and the other between locations 2 and 5. Sampling locations and their associated Shannon-Weiner Diversity Indices are shown on Figure 10-1-3. The number of fish in each sample and the range of the fish lengths is provided in Table 10-1-4.



NOTE: BOLD LINES INDICATE  
COMPLETE PATHWAY



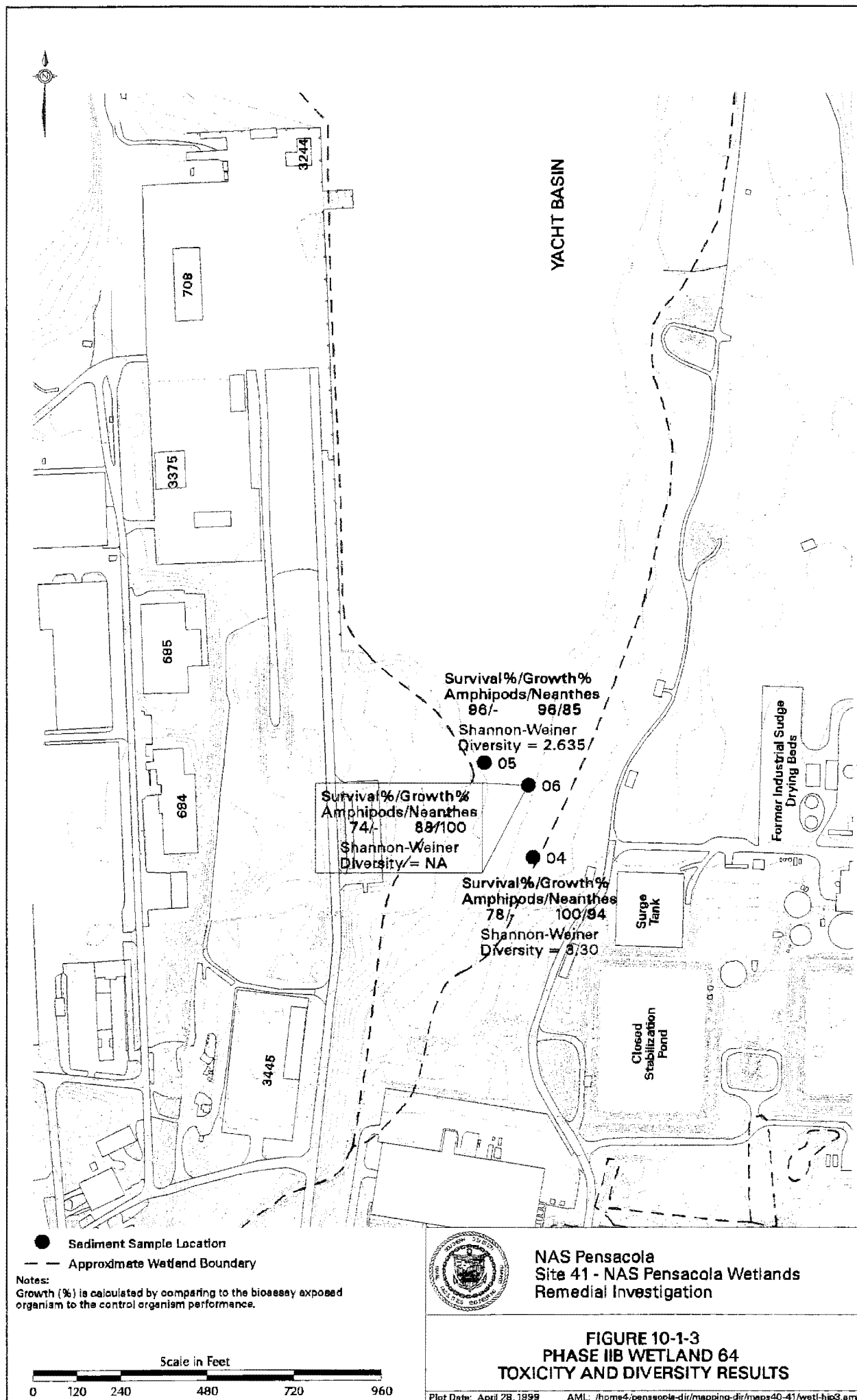
SITE 41 RI REPORT  
NAVAL AIR STATION PENSACOLA  
PENSACOLA, FLORIDA

FIGURE 10-1-2  
GROUP A: WETLAND 64  
CONCEPTUAL MODEL

DWG DATE: 03/11/99 | DWG NAME: 0036S012

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**Table 10-1-4  
Fish Collected at Wetland 64 and Reference Wetland 33**

Sample Location	Species	Number Collected	Length Range (millimeters)
64-01	Pinfish ( <i>Lagodon rhomboides</i> )	32	64-82
64-06	Pinfish ( <i>Lagodon rhomboides</i> )	20	64-80
33-01	Pinfish ( <i>Lagodon rhomboides</i> )	7	55-71
33-02	Pinfish ( <i>Lagodon rhomboides</i> )	25	54-85

### **Ecological Risk Evaluation**

Risk in Wetland 64 was evaluated with respect to three assessment endpoints: 1) piscivorous bird health and reproduction, 2) survival and growth of macroinvertebrates associated with the benthic environment, and 3) protection of fish viability. Based on the ecological risk evaluation performed at Wetland 64, sediment and surface water results can be scored via the decision making triad, and the overall condition of the wetland for sediment and surface water can be determined.

#### ***Piscivorous Bird Health and Reproduction:***

As shown in Table 10-1-5, an HQ of 1.57 is estimated for heron's exposure to total DDT levels reported in fish tissues collected from sample 64-06 using an SFF of 1 (i.e., assuming that the heron spends 100% of its time feeding in Wetland 64). HQs estimated for the remaining contaminant-receptor combinations are all below 1.

An HQ of 0.43 is calculated based on an SFF value of 0.28, which represents a more realistic estimate of risk potentially associated with the heron's exposure to residual concentrations of total DDT in fish tissues.

Table 10-1-5  
 Great Blue Heron HQ Calculations  
 Wetland 64

SFF Value	Location	Parameter	Tissue Concentration <sup>1</sup> (mg/kg)	Sediment Concentration <sup>2</sup> (mg/kg)	PDE <sup>3</sup> (mg/kg-day)	NOAEL <sup>4</sup> (mg/kg-day)	LOAEL (mg/kg-day)	HQ <sup>5</sup>
1	64-01	total DDT	0.0173	0.196	0.0031	0.003	0.028	1.03
0.28	64-01	total DDT	0.0173	0.196	0.0009 - 0.0031	0.003	0.028	0.3
1	64-06	total DDT	0.026	0.116	0.0047	0.003	0.028	1.57
0.28	64-06	total DDT	0.026	0.116	0.0013 - 0.0047	0.003	0.028	0.43
1	64-01	total PCB	0.36	0.30	0.065	0.18	1.8	0.36
0.28	64-01	total PCB	0.36	0.30	0.018 - 0.065	0.18	1.8	0.1
1	64-06	total PCB	0.041	0.18	0.0074	0.18	1.8	0.04
0.28	64-06	total PCB	0.041	0.18	0.0021 - 0.0074	0.18	1.8	0.12

Notes:

- 1 = Whole body killifish or pinfish (wet weight)
- 2 = Samples from top 5 cm of sediment (wet weight)
- 3 = Potential Dietary Exposure: revised from model in SAP (E/A&H, 1997)
- 4 = Effects Levels in Sample *et al.*, 1996
- 5 = Hazard Quotient = (PDE) ÷ (NOAEL)
- ND = Not detected
- NOAEL = No-observed-adverse-effects-level
- LOAEL = Lowest-observed-adverse-effects-level

### Survival and Growth of Macroinvertebrates Associated with the Benthic Environment:

As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach.

### Sediment Chemistry

Table 10-1-6 compares detected Phase IIB/III sediment concentrations to benchmark levels, and lists calculated HQs for each parameter. DDT and its metabolites are also compared to basewide levels (see Section 6). Only the detected parameters with benchmark levels or water quality criteria are presented in Table 10-1-6. Phase IIB/III sediment analytical results for Wetland 64 showed HQs above 1 for pesticides, PAHs, phthalate esters, PCBs, and metals. Application of these sediment chemistry results to the decision making triad revealed a matrix score of “+” for sediment chemistry.

Table 10-1-6 (1)  
Wetland 64  
Phase II/III Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>D41M640501</b>					
	4,4'-DDD (UG/KG)	30	1.22	24.59	b
	4,4'-DDE (UG/KG)	33	2.07	15.94	b
	Acenaphthene (UG/KG)	310	6.71	46.20	b
	alpha-Chlordane (UG/KG)	2.9	1.7	1.71	a
	Anthracene (UG/KG)	340	46.9	7.25	b
	Arsimony (MG/KG)	2.5	12	0.21	a
	Aroclor-1260 (UG/KG)	280	21.5	12.96	b
	Arsenic (MG/KG)	6.9	7.24	0.95	a b
	Benzo(a)anthracene (UG/KG)	1300	74.6	17.38	b
	Benzo(a)pyrene (UG/KG)	1200	88.8	13.51	a
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	2000	182	10.99	b
	Cadmium (MG/KG)	17.7	0.68	26.03	b
	Chromium (MG/KG)	592	52.3	11.32	a b
	Chrysene (UG/KG)	1300	108	12.04	b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

Table 10-1-6 (2)  
Welland 64  
Phase IIB/III Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV- HQ Reference
	Copper (MG/KG)	146	18.7	7.81	a b
	Dieldrin (UG/KG)	17	0.72	23.61	b
	Fluoranthene (UG/KG)	2800	413	24.78	b
	Fluorene (UG/KG)	290	21.2	13.68	b
	Lead (MG/KG)	330	30.2	10.93	a b
	Mercury (MG/KG)	0.26	0.13	2.00	a b
	Naphthalene (UG/KG)	110	34.6	3.18	b
	Nickel (MG/KG)	12.3	15.9	0.77	a b
	Phenanthrene (UG/KG)	2000	66.7	23.07	b
	Pyrene (UG/KG)	3000	163	19.61	b
	Silver (MG/KG)	3	0.73	4.11	b
	Zinc (MG/KG)	306	124	2.47	a b

**Notes**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding

### Sediment Toxicity

Survival results in the *Leptocheirus plumulosus* test were 74% and above, and 88% and above for *Neanthes arenacoedentata* test, as presented in Table 10-1-7. Application of these results to the decision making triad revealed a triad matrix score of “+” for *Leptocheirus* at locations 64-04 and 64-06; “—” for *Leptocheirus* at location 64-05; and “—” for *Neanthes* at all locations. The laboratory noted a petroleum odor from the samples collected at 64-04 and 64-06.

Table 10-1-7  
 Amphipod and Polychaete Chronic Bioassay Results  
 Wetland 64 Sediment

Site	<i>Leptocheirus</i>	Triad Matrix Scoring	<i>Neanthes</i>		
	% Survival		% Survival	Weight (mg)	Triad Matrix Scoring
Control (negative)	98		100	8.5	
Wetland 64 (64-04)	78	+	100	8.0	—
Wetland 64 (64-05)	96	—	96	7.2	—
Wetland 64 (64-06)	74	+	88	8.5	—

### Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. Location 64-04 exhibited a lower diversity (1.69), when compared to other estuarine wetlands. A total of 37 organisms were collected and sorted into five dominant species. Representation was fairly even between nematodes, gastropods, polychaetes, and isopods. Between seven and 15 representatives from the “pollution tolerant” polychaete species were found, which would be expected in a highly organic environment that has experienced an impact. Cumacean representatives found at Sites 64-05 and 64-06 indicate a healthy environment, and their appearance in this area may indicate overall improvement. Blue crabs (*Callinectes sapidus*) and other decapods were sampled in this area, as were isopods and copepods. These crustaceans and zooplankton are a major part of the food web. Benthic diversity results and application to the triad matrix are presented in Table 10-1-8. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-1-8  
 Benthic Diversity Results and Application to the Toxicity Test Results  
 Wetland 64 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 64 (64-04)	2.42	1.01	10.76	—
Wetland 64 (64-05)	3.30	1.22	14.76	—
Wetland 64 (64-06)	2.64	1.14	9.79	—

Table 10-1-9 presents the interpretation of the triad analysis for the Wetland 64 Phase IIB/III sediment samples. Based on the results of the chemistry and toxicity data, conditions number 2 and 6 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

Table 10-1-9  
 Triad Analysis Interpretation  
 Wetland 64 Sediment

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 64 (64-04)	+	+	—	Toxic chemicals are probably stressing the system.
Wetland 64 (64-05)	—	—	—	Strong evidence for the absence of pollution induced degradation.
Wetland 64 (64-06)	+	+	—	Toxic chemicals are probably stressing the system.

Based on the results of the chemistry and toxicity data, condition number 2 for sediment exists for Wetland 64 location 64-05. Condition number 6 exists for locations 64-04 and 64-06. Sediment samples from 64-04 and 64-06 were noted to have strong petroleum odors, which may account for the toxicity and chemistry for these locations.

### ***Protection of Fish Viability***

Protection of fish viability was evaluated using three lines of evidence. The first line of evidence, a direct comparison of Level 3 fish tissue residue concentrations to toxic effects thresholds, does not suggest a potential risk to Level 3 fish. These HQ values are shown on Table 10-1-10.

Table 10-1-10  
Contaminant HQ Calculations from Fish Tissue Samples  
Wetland 64

Constituent	Level 3 Fish Tissue Conc (mg/kg)	Screening Ecotoxicity Value (mg/kg)	HQ
Aldrin	0.00038	0.157 <sup>1</sup>	0.0024
Aroclor-1260	0.041	0.98 <sup>2</sup>	0.042
Aroclor-1016	0.334	0.98 <sup>2</sup>	0.34
Alpha-ChlordaneC	0.0012	1.66 <sup>3</sup>	0.00072
Gamma-chlordane	0.0019	1.66 <sup>3</sup>	0.0011
Dieldrin	0.00066	12.8 <sup>4</sup>	0.00005
4,4'-DDT	0.0081	0.10 <sup>5</sup>	0.08
4,4'-DDE	0.013	0.10 <sup>5</sup>	0.13
4,4'-DDD	0.0049	0.10 <sup>5</sup>	.05
Endosulfan I	0.0012	0.195 <sup>6</sup>	0.006
Heptachlor epoxide	0.0004	3.2 <sup>7</sup>	0.000125
Lindane	0.00061	0.54 <sup>8</sup>	0.001

**Notes:**

- 1 = 0.157 mg/kg NOED for mortality in the mosquito fish, from Metcalf, R.L. (1974).
- 2 = 0.98 mg/kg NOED for mortality in the pinfish, from Duke, T.W., Lowe, J.I., and A.J. Wilson, Jr (1970).
- 3 = 16.6 mg/kg LOED for mortality in the pinfish, from Parrish, P.R., Schimmel, Hanson, D.J., S.C. Patrick, J.M., and J. Forester (1976).
- 4 = 12.8 mg/kg NOED for mortality in the sheepshead minnow from Parrish P.R., J.A. Couch, J. Forester, J.M. Patrick and G.H. Cook (1974).
- 5 = 0.10 mg/kg NOED for spiny dogfish, from Guarino, A.M. and S.T. Arnold (1979).
- 6 = 0.195 mg/kg NOED for mortality in the pinfish, from Schimmel, S.C., Patrick, J.M., and A.J. Wilson, Jr. (1977).
- 7 = 3.2 mg/kg NOED for mortality in the pinfish, Schimmel, S.C., Patrick, J.M., and J. Forester (1976).
- 8 = 0.537 mg/kg NOED for mortality in the fathead minnow from Macek, K.J., K.S. Buxton, S.K. Derr, J.W. Dean and S. Sauter (1976).

For the second line of evidence, risk to Level 4 fish were also evaluated. Risks were not predicted to level 4 fish from exposure to any chlorinated compound using an SFF of 0.043. An HQ greater than 1 (2.26) was calculated only for Aroclor-1016 and mercury using an SFF of 1. These results are shown on Table 10-1-11.



Remedial Investigation  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-1-11  
 Contaminant HQ Calculations for Level 4 Fish  
 Wetland 64

Constituent	Maximum Level 3 Fish Tissue Conc (mg/kg)	FCM	Maximum Level 4 Tissue Conc. (SFF = 1) (mg/kg)	Maximum Level 4 Tissue Conc. (SFF = 0.043) (mg/kg)	Screening Ecotoxicity Value (mg/kg)	HQ (Based on SFF = 1)	HQ (Based on SFF = 0.043)
Aldrin	0.00038	1.006	0.00038	0.000016	0.010 <sup>1</sup>	0.038	0.0016
Aroclor-1260	0.041	3.733	0.153	0.0066	0.32 <sup>2</sup>	0.48	0.021
Aroclor-1016	0.334	2.162	0.722	0.031	0.32 <sup>2</sup>	2.26	0.097
Alpha-Chlordane	0.0012	1.999	0.0024	0.0001	0.01 <sup>3</sup>	0.24	0.01
Gamma-chlordane	0.0019	1.999	0.0038	0.00016	0.01 <sup>3</sup>	0.38	0.016
4,4'-DDT	0.0081	3.254	0.026	0.0011	3.0 <sup>6</sup>	0.0087	0.00037
4,4'-DDE	0.013	3.602	0.047	0.002	3.0 <sup>6</sup>	0.016	0.00067
4,4'-DDD	0.0049	3.254	0.016	0.00069	3.0 <sup>6</sup>	0.0053	0.00023
Dieldrin	0.00066	1.063	0.0007	0.00003	1.00 <sup>3</sup>	0.0007	0.00003
Endosulfan I	0.0012	1.021	0.0012	0.000052	0.0075 <sup>4</sup>	0.16	0.00033
Heptachlor epoxide	0.0004	1.185	0.0047	0.0002	0.01 <sup>8</sup>	0.47	0.02
Lindane	0.00061	1.021	0.00062	0.000027	1.7 <sup>7</sup>	0.00036	0.000016
Mercury			2.26 <sup>9</sup>	0.097	0.14 <sup>10</sup>	16.1	0.69

Notes:

Available: <http://www.wes.army.mil/el/t2dbase.html>

- 1 = 0.10 mg/kg LOED for morphological effects in the Atlantic Salmon from Addison, R.F., M.E. Zinck and J.R. Leahy (1976)
- 2 = 0.32 mg/kg NOED for physiological effects in the mummichog, from Gallagher, K., Van Veld, P.A., Hale, R.C., and J.J. Stegeman (1995).
- 3 = 1.0 mg/kg NOED for mortality in the spiny dogfish from Guarino, A.M. and S.T. Arnold (1979).
- 4 = 0.075 mg/kg LOED for physiological effects in the rainbow trout, from Jensen, E.G., J.U. Skaare, E. Egaas and A. Goksøyr (1991).
- 5 = 0.01mg/kg NOED for mortality in the spot, from Schimmel, S.C., Patrick, J.M., and J. Forester (1976).
- 6 = 3 mg/kg NOED for morphological effects in the Atlantic Salmon, from Addison, R.F., M.E. Zinck and J.R. Leahy (1976).
- 7 = 1.7 mg/kg NOED for mortality in the Atlantic Salmon from Carlburg, G.E., *et al.* (1986).
- 8 = 0.01 mg/kg NOED for mortality in the spot, Schimmel, S.C., Patrick, J.M., and J. Forester (1976).
- 9 = The mercury concentration was calculated using the model presented in Appendix G.
- 10 = 0.14 mg/kg NOED for mortality in the rainbow trout, Boudou, A. and F. Ribeyre (1985).

The third line of evidence, comparison of surface water contaminants to water quality criteria, is shown on Table 10-1-12. Comparing the detected concentrations to water quality criteria results in an HQ greater than 1 for copper, iron, lead, and mercury.

### **Conclusion**

Because there are surface water HQ exceedances for metals, there is a potential risk to Level 3 fish species in Wetland 64 from directly toxic effects. In evaluating risk in Level 4 fish using the SFF of 0.043, there are no contaminants with an HQ greater than or equal to 1, which suggests no potential excess risk.

### **10.1.5 Human Health Risk Assessment**

#### **10.1.5.1 Samples Included**

##### **Tissue**

041J640101, 041J640601

##### **Sediment**

041M640101, 041M640201, 041M640301, 041M640401, 041M640501, 041M640601

##### **Surface Water**

None collected.

#### **10.1.5.2 Current and Future Land Use**

This site is used as a recreational fishing area, and no known plans exist to change the land use in the distant future. Navy and civilian recreational users (boating and fishing) could be exposed, probably to surface water only.

Table 10-1-12 (1)

## Wetland 64

## Phase II/III Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W64050) Saltwater</b>						
	Aluminum	UG/L	298.00	1500.00	0.20	b
	Chromium	UG/L	12.50	50.00	0.25	a b
	Copper	UG/L	4.20	2.90	1.45	a b
	Iron	UG/L	702.00	300.00	2.34	b
	Lead	UG/L	8.60	5.60	1.54	b
	Mercury	UG/L	0.08	0.03	2.40	a b
	Silver	UG/L	0.04	0.23	0.17	a b
	Toluene	UG/L	0.36	37.00	0.01	a
	Zinc	UG/L	10.10	80.00	0.12	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

#### **10.1.5.3 Sediment COPCs**

As shown in Table 10-1-13, the following sediment COPCs were identified:

- Arsenic
- Chromium
- Lead

#### **10.1.5.4 Fish Tissue COPCs**

As shown in Table 10-1-14, the following fish tissue COPCs were identified:

- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- Aldrin
- Heptachlor epoxide
- Aroclor-1016

In addition, mercury was selected as a COPC, because it was detected in 15 of 26 sediment samples and it has the potential to bioaccumulate. Due to the lack of tissue data, concentration of mercury in Level 4 fish was estimated using a model described in Appendix G.

#### **10.1.5.5 Surface Water COPCs**

No surface water data were available for this wetland, and thus no COPCs were identified.

TABLE 10-1-13  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE #1

Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 64 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Levels	Mean	Concentration Used for Screening	Background Value	Acute and Chronic Toxicity PG	Residential Soil RBC	Potential APART/BC Source	Flag	Database for Chemical Selection
95501	1,2-Dichlorobenzene	100	J	140	J	UGKGS	041M040401	1 / 24	410.00 - 27000.00	190	190	N/A	20000000	700	N	N/A	BSL
106487	1,4-Dichlorobenzene	70	J	260	J	UGKGS	041M040501	2 / 24	410.00 - 27000.00	165	260	N/A	920000	27	C	N/A	BSL
91576	2-Methylnaphthalene	30	J	30	J	UGKGS	041M040101	1 / 24	410.00 - 27000.00	30	30	N/A	6300000	310000	N	N/A	BSL
72548	4,4'-DDE	0.2	J	140	J	UGKGS	041M041301	14 / 24	410.00 - 27000.00	21	140	N/A	92000	2700	C	N/A	BSL
72559	4,4'-DDD	0.36	J	76	J	UGKGS	041M041201	14 / 24	410.00 - 27000.00	16	76	N/A	95000	1800	C	N/A	BSL
50283	4,4'-DDE	0.6	J	143	J	UGKGS	041M040901	6 / 24	410.00 - 27000.00	5.2	143	N/A	16000	1900	C	N/A	BSL
83329	Acenaphthene	120	J	230	J	UGKGS	041M040101	2 / 24	410.00 - 27000.00	176	230	N/A	14000000	470000	N	N/A	BSL
206066	Acenaphthylene	90	J	90	J	UGKGS	041M040501	1 / 24	410.00 - 27000.00	90	90	N/A	19000000	230000	N	N/A	BSL
67641	Acetone	8	J	420	J	UGKGS	041M041901	10 / 24	410.00 - 27000.00	152	420	N/A	32000000	780000	N	N/A	BSL
359022	Aldrin	0.17	J	4	J	UGKGS	041M040601	5 / 24	410.00 - 27000.00	2	4	N/A	1300	38	C	N/A	BSL
519646	alpha-BHC	0.12	J	5.94	J	UGKGS	041M041301	8 / 24	410.00 - 27000.00	0.43	5.94	N/A	3500	100	C	N/A	BSL
9103716	alpha-Chlorodene	0.28	J	10	J	UGKGS	041M040201	4 / 24	410.00 - 27000.00	4	10	N/A	93000	1900	C	N/A	BSL
7429405	Aluminum (Al)	28.8	J	29300	J	UGKGS	041M041001	26 / 26	NAV	8010	29000	N/A	320000	7800000	N	N/A	BSL
129127	Anthracene	250	J	338	J	UGKGS	041M040101	2 / 24	410.00 - 27000.00	280	338	N/A	85000000	2300000	N	N/A	BSL
7440360	Antimony (Sb)	0.19	J	10.0	J	UGKGS	041M041501	4 / 26	410.00 - 27000.00	3	10.8	N/A	130	3.1	N	N/A	BSL
11097861	Aroclor-1254	1.3	J	370	J	UGKGS	041M040101	8 / 24	410.00 - 27000.00	60	370	N/A	11000	180	N	N/A	BSL
1109925	Aroclor-1260	1.3	J	52	J	UGKGS	041M041301	12 / 24	410.00 - 27000.00	16	50	N/A	11000	320	C	N/A	BSL
1443382	Arsenic (As)	0.16	J	16.8	J	UGKGS	041M042401	19 / 26	410.00 - 27000.00	7	18.7	N/A	15	6.45	C	N/A	BSL
7413333	Barium (Ba)	0.26	J	1296	J	UGKGS	041M040101	23 / 26	410.00 - 27000.00	65	1296	N/A	22000	550	N	N/A	BSL
59553	Benz(a)anthracene	27	J	1400	J	UGKGS	041M041101	12 / 24	410.00 - 27000.00	358	1400	N/A	36000	880	C	N/A	BSL
53326	Benz(a)pyrene	25	J	912	J	UGKGS	041M040101	13 / 24	410.00 - 27000.00	258	910	N/A	3000	98	C	N/A	BSL
205992	Benz(b)fluoranthene	21	J	2650	J	UGKGS	041M040701	16 / 24	410.00 - 27000.00	532	2600	N/A	36000	680	C	N/A	BSL
191242	Benz(g,h)perylene	29	J	580	J	UGKGS	041M040101	9 / 24	410.00 - 27000.00	287	580	N/A	8500000	230000	N	N/A	BSL
207196	Benz(k)fluoranthene	35	J	250	J	UGKGS	041M040501	7 / 24	410.00 - 27000.00	179	250	N/A	300000	8800	C	N/A	BSL
1440471	Biphenyl (Bip)	0.11	J	13	J	UGKGS	041M041401	11 / 26	410.00 - 27000.00	0.8	13	N/A	530	16	N	N/A	BSL
117417	Isod-Ethylbenzylphthalate (IEBIP)	55	J	530	J	UGKGS	041M041801	3 / 24	410.00 - 27000.00	261	530	N/A	3500	46000	C	N/A	BSL
85687	Butybenzylphthalate	28	J	282	J	UGKGS	041M040101	8 / 24	410.00 - 27000.00	142	280	N/A	83000000	1500000	N	N/A	BSL
7440436	Calcium (Ca)	0.19	J	38.6	J	UGKGS	041M041001	25 / 26	410.00 - 27000.00	9.4	38.8	N/A	320	7.8	N	N/A	BSL
7440702	Calcium (Ca)	64.4	J	6630	J	UGKGS	041M040101	26 / 26	NAV	1636	6630	N/A	N/A	N/A	N/A	N/A	EN
98748	Carbazole	200	J	400	J	UGKGS	041M042401	2 / 24	410.00 - 27000.00	315	400	N/A	1100000	32000	C	N/A	BSL
75150	Carbon disulfide	11	J	11	J	UGKGS	041M041901	1 / 24	410.00 - 27000.00	11	11	N/A	32000000	7900000	N	N/A	BSL
139027	Chlorobenzene	48	J	48	J	UGKGS	041M040101	1 / 24	410.00 - 27000.00	48	48	N/A	8300000	160000	N	N/A	BSL
7440473	Chromium (Cr)	0.55	J	1600	J	UGKGS	041M040401	26 / 26	410.00 - 27000.00	432	1800	N/A	1600	23	N	N/A	BSL
210016	Chrysene	23	J	1500	J	UGKGS	041M040601	13 / 24	410.00 - 27000.00	368	1500	N/A	3000000	86000	C	N/A	BSL
7440484	Cobalt (Co)	0.13	J	8.4	J	UGKGS	041M041701	16 / 26	410.00 - 27000.00	2.7	8.4	N/A	19000	470	N	N/A	BSL
7440508	Copper (Cu)	0.74	J	256	J	UGKGS	041M040701	24 / 26	410.00 - 27000.00	51	255	N/A	13000	310	N	N/A	BSL
537103	Dibenz(a,h)anthracene	25	J	25	J	UGKGS	041M040101	1 / 24	410.00 - 27000.00	25	25	N/A	3000	68	C	N/A	BSL
132640	Dibenzofuran	72	J	96	J	UGKGS	041M040501	2 / 24	410.00 - 27000.00	79	96	N/A	130000	31000	N	N/A	BSL
83571	Dieldrin	0.79	J	33	J	UGKGS	041M040101	5 / 24	410.00 - 27000.00	1.7	33	N/A	1400	40	C	N/A	BSL
84582	Diallylphthalate	80	J	2000	J	UGKGS	041M041901	3 / 24	410.00 - 27000.00	887	2000	N/A	250000000	6300000	N	N/A	BSL
131113	Dimethyl phthalate	510	J	510	J	UGKGS	041M042201	1 / 24	410.00 - 27000.00	510	510	N/A	100000000	7800000	N	N/A	BSL
84742	Di-n-butylphthalate	28	J	430	J	UGKGS	041M041601	6 / 24	410.00 - 27000.00	196	430	N/A	32000000	780000	N	N/A	BSL
959989	Endosulfan I	0.76	J	0.76	J	UGKGS	041M040401	1 / 24	410.00 - 27000.00	0.76	0.76	N/A	1600000	47000	N	N/A	BSL
33213639	Endosulfan II	1.7	J	1.7	J	UGKGS	041M040401	1 / 24	410.00 - 27000.00	1.7	1.7	N/A	1600000	47000	N	N/A	BSL
72239	Endrin	0.46	J	8.96	J	UGKGS	041M041301	5 / 24	410.00 - 27000.00	3.81	8.9	N/A	86000	2366	N	N/A	BSL
7421834	Endrin aldehyde	0.29	J	9.29	J	UGKGS	041M041301	1 / 24	410.00 - 27000.00	0.29	9.29	N/A	86000	2366	N	N/A	BSL
206440	Fluoranthene	24	J	5700	J	UGKGS	041M040201	19 / 24	410.00 - 27000.00	782	5700	N/A	12400000	310000	N	N/A	BSL
66737	Fluorene	160	J	210	J	UGKGS	041M040501	2 / 24	410.00 - 27000.00	185	210	N/A	13000000	310000	N	N/A	BSL
58869	gamma-BHC (Lindane)	0.13	J	1.6	J	UGKGS	041M041201	5 / 24	410.00 - 27000.00	0.49	1.6	N/A	53000	400	C	N/A	BSL
5103742	gamma-Chlorodene	0.68	J	8.5	J	UGKGS	041M041301	5 / 24	410.00 - 27000.00	3.0	8.5	N/A	63000	1000	C	N/A	BSL
76446	Heptachlor	0.12	J	0.12	J	UGKGS	041M041501	1 / 24	410.00 - 27000.00	0.12	0.12	N/A	4500	140	C	N/A	BSL
193396	Isodendro[1,2,3-d]pyrene	39	J	620	J	UGKGS	041M041301	8 / 24	410.00 - 27000.00	232	620	N/A	30000	890	C	N/A	BSL
7438895	Iren (Fe)	26	J	36200	J	UGKGS	041M041201	26 / 26	NAV	11377	36200	N/A	N/A	N/A	N/A	N/A	EN
7439821	Lead (Pb)	0.65	J	534	J	UGKGS	041M040601	25 / 26	410.00 - 27000.00	134	634	N/A	400	400	OSWNR	YES	BSL
7439864	Magnesium (Mg)	47.1	J	9390	J	UGKGS	041M040601	26 / 26	NAV	2578	9390	N/A	N/A	N/A	N/A	N/A	EN
7438885	Manganese (Mn)	0.12	J	203	J	UGKGS	041M041901	26 / 26	NAV	50	203	N/A	15000	1100	N	N/A	BSL
7438876	Mercury (Hg)	0.1	J	0.9	J	UGKGS	041M041801	15 / 26	410.00 - 27000.00	0.37	0.88	N/A	35	2.3	N	N/A	BSL
75052	Methylene chloride	64	J	400	J	UGKGS	041M041901	5 / 24	410.00 - 27000.00	183	400	N/A	2900000	86000	C	N/A	BSL
81203	Naphthalene	56	J	71	J	UGKGS	041M040101	2 / 24	410.00 - 27000.00	64	71	N/A	13000000	310000	N	N/A	BSL
7440220	Nickel (Ni)	1	J	27	J	UGKGS	041M042301	18 / 26	410.00 - 27000.00	9	27	N/A	9300	180	N	N/A	BSL
85018	Phenanthrene	42	J	2800	J	UGKGS	041M040101	12 / 24	410.00 - 27000.00	540	2800	N/A	8500000	230000	N	N/A	BSL
108932	Phenol	220	J	220	J	UGKGS	041M040401	1 / 24	410.00 - 27000.00	220	220	N/A	190000000	4700000	N	N/A	BSL
7440397	Potassium (K)	19.9	J	4920	J	UGKGS	041M042001	25 / 26	410.00 - 27000.00	1083	4920	N/A	N/A	N/A	N/A	N/A	EN
129055	Pyrene	22	J	4620	J	UGKGS	041M040201	19 / 24	410.00 - 27000.00	968	4620	N/A	9500000	230000	N	N/A	BSL
7782492	Selenium (Se)	0.34	J	3.10	J	UGKGS	041M041001	11 / 26	410.00 - 27000.00	1.48	3.1	N/A	1500	39	N	N/A	BSL
7440224	Silver (Ag)	0.37	J	5.10	J	UGKGS	041M040301	4 / 26	410.00 - 27000.00	1.45	5.1	N/A	1600	38	N	N/A	BSL
7440235	Sodium (Na)	43.8	J	30200	J	UGKGS	041M040501	75 / 26	410.00 - 27000.00	8011	32200	N/A	N/A	N/A	N/A	N/A	EN
7440280	Thallium (Tl)	0.65	J	1.2	J	UGKGS	041M040401	2 / 26	410.00 - 27000.00	0.9	1.2	N/A	22	0.55	N	N/A	BSL
7440622	Vanadium (V)	0.42	J	80.7	J	UGKGS	041M040401	24 / 26	410.00 - 27000.00	15.8	80.7	N/A	2200	55	N	N/A	BSL
7440686	Zinc (Zn)	2.2	J	481	J	UGKGS	041M042201	25 / 26	410.00 - 27000.00	125	481	N/A	95000	2300	N	N/A	BSL

(1) Maximum/minimum detected concentration

(2) Maximum concentration used for screening value

(3) No background values were developed for this media

(4) PRI for site temperature estimate calculated based on equations and parameters presented in Section 8 of this report

(5) Residential soil RBCs are presented in USEPA Region II Risk-Based Concentration Tables, 1998

(6) Relative Codes

Selection Reason

Above Screening Levels (ASL)

Below Screening Levels (BSL)

TABLE 10-1-14  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Timeframe: Future  
Medium: Fish  
Exposure Medium: Fish  
Exposure Point: Wetland 64 Fish

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Fish Tissue RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	4.8	J	4.9		UG/KG	041J640101	2 / 2	NAV	4.85	15.9	N/A	13.1	C	N/A	YES	ASL
72559	4,4'-DDE	9.6		13		UG/KG	041J640601	2 / 2	NAV	11.3	46.8	N/A	9.3	C	N/A	YES	ASL
50293	4,4'-DDT	2.8	J	8.1		UG/KG	041J640601	2 / 2	NAV	5.45	28.6	N/A	9.3	C	N/A	YES	ASL
309002	Aldnn	0.38	J	0.38	J	UG/KG	041J640101	1 / 2	3.4 - 3.4	0.38	0.4	N/A	0.2	C	N/A	YES	ASL
12674112	Aroclor-1016	334		334		UG/KG	041J640101	1 / 2	66 - 66	334	780.6	N/A	406	N	N/A	YES	ASL
11096825	Aroclor-1260	26	J	41	J	UG/KG	041J640601	2 / 2	NAV	33.5	153.1	N/A	406	C	N/A	NO	BSL
60571	Dieldrin	0.66	J	0.66	J	UG/KG	041J640101	1 / 2	0.8 - 0.8	0.66	0.7	N/A	2.4	C	N/A	NO	BSL
95988	Endosulfan I	0.19	J	1.2	J	UG/KG	041J640601	2 / 2	NAV	0.695	1.2	N/A	9.0	N	N/A	NO	BSL
1024573	Heptachlor epoxide	0.40	J	0.40	J	UG/KG	041J640601	1 / 2	1.7 - 1.7	0.4	0.5	N/A	0.35	C	N/A	YES	ASL
7439921	Lead (Pb)	1.9		2.5		MG/KG	041J640601	2 / 2	NAV	2.2	112.5	N/A	N/A	N/A	N/A	YES	COM, NTX
5103719	alpha-Chlordane	1.2	J	1.2	J	UG/KG	041J640601	1 / 2	0.39 - 0.39	1.2	2.4	N/A	9	C	N/A	NO	BSL
58899	gamma-BHC (Lindane)	0.44	J	0.61	J	UG/KG	041J640601	2 / 2	NAV	0.525	0.6	N/A	2.4	C	N/A	NO	BSL
5103742	gamma-Chlordane	1.9	J	1.9	J	UG/KG	041J640601	1 / 2	0.67 - 0.67	1.9	3.8	N/A	9	C	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) The screening value was calculated using the following equation:

The screening value=(maximum concentration)\*(trophic transfer coefficient)

(3) This chemical was not detected at background sampling locations.

(4) RBCs for site trespasser scenario. Calculated based on toxicity values presented in USEPA Region III Risk-Based Concentration Tables, 1998.

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
COPC in Other Media (COM)

Definitions: N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

#### **10.1.5.6 Risk Characterization**

##### **Sediment**

As shown in Table 10-1-15, arsenic is the only contributor to cancer risk estimates for Wetland 64's sediment pathway. The cumulative risk estimated for this wetland is  $1.5E-6$ . The HI shown in Table 10-1-16 was estimated to be 0.25. Arsenic was identified as a COC in surface water based on its contribution to the cumulative risk estimate for this wetland. Table 10-1-17 summarizes cancer risk and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed .

##### **Lead**

A conservative exposure scenario was developed to assess the significance of lead concentrations reported in sediment and fish tissue samples collected at Wetland 64. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. It is assumed that they visit Wetland 64 to catch fish. These exposures were considered additional to those typically encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were retained to simulate background exposure to conservatively estimate daily intake from sources unrelated to Wetland 64.

The assumption was made that this child would incidentally ingest 100 milligrams of sediment and 54 grams of fish tissue once a week throughout the year, represented in the Lead Model as an alternate source. The bioavailability of lead ingested from the alternate source (Wetland 64 sediment and fish tissue) was equal to that of house dust lead ingested from the standard residential default source. Assuming incidental ingestion of 100 milligrams of sediment and 54 grams of fish tissue once per week for one year, with maximum lead concentrations of 643 mg/kg in sediment and 2.5 mg/kg in bait fish tissue, the annual alternate source exposure was

TABLE 10-1-15  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 64

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	18.70	MG/KG	M	8.5E-07	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	1E-06
Dermal	Arsenic	18.70	MG/KG	M	3.5E-08	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	3E-07
Total Risk All Exposure Routes/Pathways									2E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



TABLE 10-1-16  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 64  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	18.70	MG/KG	M	5.92E-06	mg/kg-day	3.00E-04	mg/kg-day	2E-02
	Chromium	1800	MG/KG	M	5.70E-04	mg/kg-day	3.00E-03	mg/kg-day	2E-01
Dermal	Arsenic	18.70	MG/KG	M	2.43E-07	mg/kg-day	6.00E-05	mg/kg-day	4E-03
	Chromium	1800	MG/KG	M	2.30E-05	mg/kg-day	6.00E-04	mg/kg-day	4E-02
Total Hazard Index Across All Exposure Routes/Pathways									3E-01

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-1-17  
SUMMARY OF RISK  
SEDIMENT  
NAS PENSACOLA  
SITE 41

Timeframe: Current and Future  
Receptor Population: Site Trespasser  
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal	Total		Primary Target Organ	Ingestion	Dermal	Total
Sediment	Sediment	Wetland 64	Arsenic	1.28E-06	2.63E-07	2E-06	Arsenic	skin	0.02	0.004	2E-02
						Chromium	None reported	0.19	0.04	2E-01	
			(Total)	1.28E-06	2.63E-07	2E-06	(Total)		0.21	0.042	3E-01
Total Risk Across All Exposure Routes/Pathways						2E-06	Total Hazard Index Across All Exposure Routes/Pathways				3E-01

estimated to be 0.009 mg lead/day. Table 10-1-18 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-1-4 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 3.1  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.65%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, sediment and fish tissue lead concentrations at Wetland 64 would not require specific action under the hypothetical exposure scenario.

#### ***Fish Tissue Ingestion***

##### ***Recreational Fishermen***

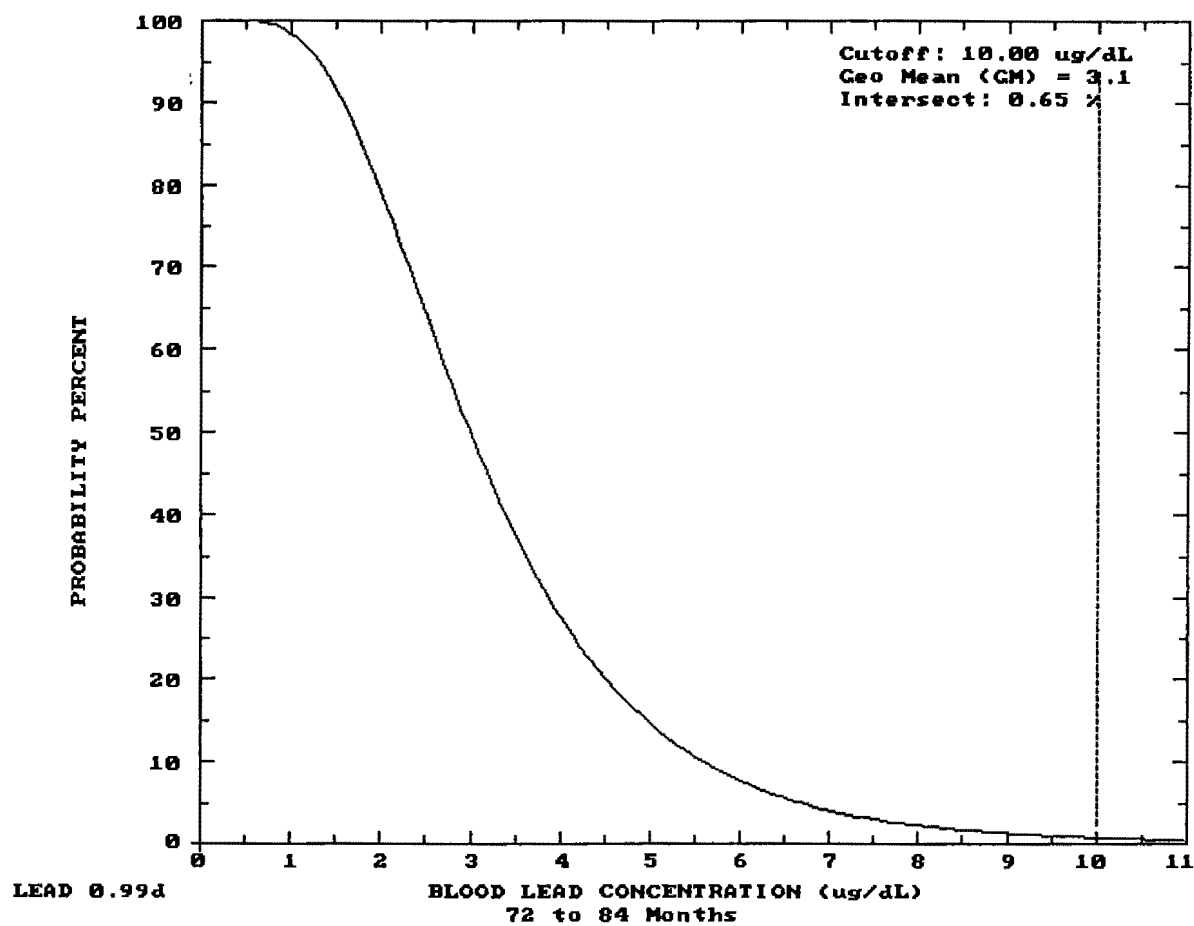
For carcinogenic risks (Table 10-1-19), cumulative risk using the modified 95<sup>th</sup> percentile fish ingestion rates (4.3 g/day) is below the 1E-06 threshold level. For noncarcinogenic risks (Table 10-1-20), the calculated hazard index is below the threshold level of 1.

##### ***Hypothetical Subsistence Fishermen***

For carcinogenic risks (Table 10-1-21), the cumulative risk for hypothetical subsistence fishermen based on the modified 95% percentile fish ingestion rate (19.5 g/day) is below the 1E-06 threshold level. For the noncarcinogenic risk (Table 10-1-22), the hazard index for hypothetical subsistence fishermen is below 1.

A summary of the risk estimates for both of the fishermen populations evaluated is presented in Table 10-1-23.

Figure 10-1-4 Probability Percentage of Blood Lead Levels, Hypothetical Child Receptor



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**Table 10-1-18**  
**Lead Model (Version 0.99d) Inputs and Results**  
**NAS Pensacola, Wetland 64**  
**Pensacola, Florida**

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 64 sediment and fish tissue

6-7: 9.19 ug Pb/day

MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)	Diet Uptake (ug/day)	Water Uptake (ug/day)	Alt. Source Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	3.1	11.98	4.84	3.32	1.12	2.61	0.09

TABLE 10-1-19  
CARCINOGENIC RISK TO RECREATIONAL FISHERMEN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 64  
Receptor Population: Recreational Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake (Cancer)	Intake (Cancer) Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDD	4.9E-03	mg/kg	1.7E-08	mg/kg-day	2.4E-01	(mg/kg-day) <sup>-1</sup>	4E-09
4,4'-DDE	1.3E-02	mg/kg	5.0E-08	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	2E-08
4,4'-DDT	8.1E-03	mg/kg	3.1E-08	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	1E-08
Aldrin	3.8E-04	mg/kg	4.1E-10	mg/kg-day	1.7E+01	(mg/kg-day) <sup>-1</sup>	7E-09
Aroclor-1016	3.3E-01	mg/kg	8.3E-07	mg/kg-day	7.0E-02	(mg/kg-day) <sup>-1</sup>	6E-08
Heptachlor epoxide	4.0E-04	mg/kg	5.7E-10	mg/kg-day	9.1E+00	(mg/kg-day) <sup>-1</sup>	1E-08
Mercury <sup>2</sup>	2.3E+00	mg/kg	NA	mg/kg-day	NA	(mg/kg-day) <sup>-1</sup>	NA
Total Pathway Risk							1E-07

<sup>1</sup> Except for mercury, the EPC was derived by multiplying the maximum detected concentration (in bait fish) by the TTC.

For mercury, the EPC was calculate during the mercury model presented in appendix G.

<sup>2</sup> No risk can be calculated because slope factor does not exist and chemical is not considered carcinogenic.

TABLE 10-1-20  
NONCARCINOGENIC RISK TO RECREATIONAL FISHERMEN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 64  
Receptor Population: Recreational Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDD <sup>2</sup>	4.9E-03	mg/kg	4.0E-08	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDE <sup>2</sup>	1.3E-02	mg/kg	1.2E-07	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDT	8.1E-03	mg/kg	7.1E-08	mg/kg-day	5.0E-04	mg/kg-day	1E-04
Aldrin	3.8E-04	mg/kg	9.5E-10	mg/kg-day	3.0E-05	mg/kg-day	3E-05
Aroclor-1016	3.3E-01	mg/kg	1.9E-06	mg/kg-day	7.0E-05	mg/kg-day	3E-02
Heptachlor epoxide	4.0E-04	mg/kg	1.3E-09	mg/kg-day	1.3E-05	mg/kg-day	1E-04
Mercury	2.3E+00	mg/kg	5.6E-06	mg/kg-day	1.00E-04	mg/kg-day	6E-02
Total Pathway HI							8E-02

<sup>1</sup> For fish tissue intake calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.



TABLE 10-1-21  
CARCINOGENIC RISK TO HYPOTHETICAL SUBSISTENCE FISHERMEN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 64  
Receptor Population: Hypothetical Subsistence Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDD	4.9E-03	mg/kg	7.8E-08	mg/kg-day	2.4E-01	(mg/kg-day) <sup>-1</sup>	2E-08
4,4'-DDE	1.3E-02	mg/kg	2.3E-07	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	8E-08
4,4'-DDT	8.1E-03	mg/kg	1.4E-07	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	5E-08
Aldrin	3.8E-04	mg/kg	1.9E-09	mg/kg-day	1.7E+01	(mg/kg-day) <sup>-1</sup>	3E-08
Aroclor-1016	3.3E-01	mg/kg	3.8E-06	mg/kg-day	7.0E-02	(mg/kg-day) <sup>-1</sup>	3E-07
Heptachlor epoxide	4.0E-04	mg/kg	9.7E-09	mg/kg-day	9.1E+00	(mg/kg-day) <sup>-1</sup>	5E-08
Mercury <sup>2</sup>	2.3E+00	mg/kg	NA	mg/kg-day	NA	(mg/kg-day) <sup>-1</sup>	NA
Total Pathway Risk							5E-07

<sup>1</sup> For fish tissue intake calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> No risk can be calculated because slope factor does not exist and chemical is not considered carcinogenic.

TABLE 10-1-22  
NONCARCINOGENIC RISK TO HYPOTHETICAL SUBSISTENCE FISHERMEN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 64  
Receptor Population: Hypothetical Subsistence Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDD <sup>2</sup>	4.9E-03	mg/kg	1.8E-07	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDE <sup>2</sup>	1.3E-02	mg/kg	5.4E-07	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDT	8.1E-03	mg/kg	3.3E-07	mg/kg-day	5.0E-04	mg/kg-day	7E-04
Aldrin	3.8E-04	mg/kg	4.4E-09	mg/kg-day	3.0E-05	mg/kg-day	1E-04
Aroclor-1016	3.3E-01	mg/kg	9.0E-06	mg/kg-day	7.0E-05	mg/kg-day	1E-01
Heptachlor epoxide	4.0E-04	mg/kg	1.4E-08	mg/kg-day	1.3E-05	mg/kg-day	2E-06
Mercury	2.3E+00	mg/kg	2.6E-05	mg/kg-day	1.00E-04	mg/kg-day	3E-01
Total Pathway HI							4E-01

<sup>1</sup> For fish tissue intake calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.

TABLE 10-1-23  
SUMMARY OF RISK  
FISH INGESTION  
NAS PENSACOLA  
SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 64

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Recreational Fishermen		Subsistence Fishermen	
			Hazard Quotient	Carcinogenic Risk	Hazard Quotient	Carcinogenic Risk
4,4'-DDD	4.9E-03	mg/kg	NA	4E-09	NA	2E-08
4,4'-DDE	1.3E-02	mg/kg	NA	2E-08	NA	8E-08
4,4'-DDT	8.1E-03	mg/kg	1.43E-04	1E-08	6.58E-04	5E-08
Aldrin	3.8E-04	mg/kg	3.17E-05	7E-09	1.46E-04	3E-08
Aroclor-1016	3.3E-01	mg/kg	2.78E-02	6E-08	1.28E-01	3E-07
Heptachlor epoxide	4.0E-04	mg/kg	1.03E-04	1E-08	2.33E-06	5E-08
Mercury	2.3E+00	mg/kg	5.62E-02	NA	2.60E-01	NA
Cumulative HI / Cancer Risk			8.43E-02	1.08E-07	3.90E-01	5E-07

N/A - Not applicable (value cannot be determined due to lack of toxicological reference information)

<sup>1</sup> For fish tissue intake calculations, the maximum detected concentration was used as the EPC.

#### **10.1.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1995). Arsenic was identified as a COC at this wetland based on its contribution to cancer risk estimates for the sediment pathway. Because arsenic was identified as a COC based on cancer risk and not hazard index estimates, only risk-based RGOs were developed. As shown in Table 10-1-15, the sediment exposure point concentration of 18.7 mg/kg-day resulted in a risk estimate of 1.5E-6 for arsenic. RGOs for arsenic in sediment for the adolescent trespasser are 12.24 mg/kg, 122.4 mg/kg, and 1,224 mg/kg for target risk levels of 1E-6, 1E-5, and 1E-4, respectively.

#### **10.1.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was identified as a COC at this wetland based on its contribution to cancer risk estimates for the sediment pathway. Because arsenic was identified as a COC based on cancer risk and not hazard index estimates, only risk-based RGOs were developed. As shown in Table 10-1-16, the sediment exposure point concentration of 18.7 mg/kg-day resulted in a risk estimate of 1.5E-6 for arsenic. RGOs for arsenic in sediment for the adolescent trespasser are 12.24 mg/kg, 122.4 mg/kg, and 1,224 mg/kg for target risk levels of 1E-6, 1E-5, and 1E-4, respectively.

#### **10.1.6 Conclusions and Recommendations**

The Wetland 64 complex includes the NAS Pensacola Yacht Basin and those wetland areas immediately upstream (Wetlands 7, 8, 64, and the downstream end of Wetland 6). The ecological risk assessment for Wetland 64 measured assessment endpoints for piscivorous bird health and reproduction, benthic macroinvertebrate community toxicity and diversity, and for protection of fish viability. Using a SFF of 1, the HQ for DDT exposure for the heron was above 1 at only

one Phase IIB/III sample location at Wetland 64. Assessments for benthic diversity and toxicity showed acute effects at two sample locations for the marine amphipod *Leptocheirus plumulosus*. No acute or toxic effects were noted for the marine polychaete *Neanthes arenacoedentata* at any of the sample locations. Species diversity was noted to be fairly even between nematodes, gastropods, polychaetes, and isopods, and included between seven and 15 representatives from the pollution tolerant polychaet species. Based on the results of the chemistry and toxicity data, condition number 2 for sediment exists for Wetland 64 location 64-05. Condition number 6 exists for locations 64-04 and 64-06. Sediment samples from 64-04 and 64-06 were noted to have strong petroleum odors, which may account for the survival effects noted for these locations. Because there are surface water HQ exceedances for metals, there is a potential risk to Level 3 fish species in Wetland 64 from directly toxic effects. In evaluating risk in Level 4 fish using the SFF of 0.043, there are no contaminants with an HQ greater than or equal to 1, which suggests no potential risk.

The HHRA identified several pesticide and PCB constituents as fish tissue COPCs. Three metals were identified as sediment COPCs. No surface water COPCs were noted. The cumulative risk estimated for arsenic in sediment at this wetland is  $1.5E-6$ . A sediment EPC for arsenic of 18.7 mg/kg-day resulted in a risk estimate of  $1.5E-6$ . RGOs for arsenic in sediment for the adolescent trespasser are 12.24 mg/kg, 122.4 mg/kg, and 1,224 mg/kg for target risk levels of  $1E-6$ ,  $1E-5$ , and  $1E-4$ , respectively. Using USEPA guidelines, sediment and fish tissue lead concentrations at Wetland 64 would not require specific action under the hypothetical exposure scenario. Fish tissue COPCs (adjusted for trophic transfer coefficients) were compared to fish ingestion RBCs, and equated to a risk of  $1E-06$ . Linear ratio analyses reveal cancer target risks ranging from  $1.3E-6$  for alpha-chlordane to  $1.5E-3$  for Aroclor 1016. Noncancer hazards for fish tissue COPCs ranged from 0.18 for alpha-chlordane to 14.6 for Aroclor 1016.

The NAS Pensacola Yacht Basin is used to launch and dock sailboats. The area of the Yacht Basin contained within the investigative area for Wetland 64 is not conducive to other water sports or recreational activities. A small beach on the northwest side of the clubhouse (on Bayou Grande, outside of the area of investigation) is the designated swimming area for this facility, and the area for launching and beaching smaller boats. On the Yacht Basin side, a concrete seawall meets the water's edge, limiting swimming and wading. The Site 40 RI (EnSafe, 1999) identified that fishing and crabbing activities are allowed in Bayou Grande, an area that includes the NAS Pensacola yacht Basin. However, the Site 40 RI revealed that Bayou Grande does not support sufficient game for subsistence fishing. Recreational fishing generally occurs during the warmer months of the year, and commercial fishing is restricted because of the Florida net-ban. Therefore, the overall impact from consuming fish originating in Bayou Grande, and the Yacht Basin is considered to be insignificant.

Based on the findings of petroleum contaminants in the Wetland 64 sediments at locations of toxicity, this wetland is recommended for transfer to the State of Florida petroleum program.

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## **10.2 Wetland 5A/5B**

### **10.2.1 Site Description**

Wetland 5 is located in a wooded area within the developed portion of NAS Pensacola. It is flanked to the west by the A.C. Read Golf Course, to the north by the former NADEP Dynamic Components Division and other buildings formerly used by NADEP, and to the south by Taylor Road. Parsons and Pruitt (USEPA, 1991) divided this wetland into two parts, 5A and 5B. They described Wetland 5A as a palustrine forested system, and Wetland 5B as a palustrine emergent system.

Wetland 5A (roughly 1.3 acres in size) is connected to Wetland 5B (1.2 acres) by a culvert which runs under Murray Road. Wetland 5A is bordered by Murray Road to the east, the golf course to the west, and buildings to the north and south. A 200-300 foot vegetative buffer surrounding this area likely offers habitat to various species. The open water portion of the wetland ranges from 0 to 3 feet in depth, and varies from 80-150 feet in width. Sediments collected at this site detected up to 40% TOC.

Little history is available concerning the origins of Wetland 5A, which is several decades old and likely began as a man made feature (a borrow pit). It served as a drainage pathway as early as the 1940s, and reportedly contained a saw mill during that time. In recent years, beaver dams constructed at the downstream end raised the water level in the basin which contains this wetland, facilitating sedimentation and the emergence of a marsh there. Since 1994, the water level in Wetland 5A has somewhat receded, after a faulty valve in a nearby potable water storage tank was repaired. Previously, several thousand gallons of potable water per day accidentally discharged from this tank into Wetland 5A via an overflow pipeline. Wetland 5A continues to serve as a storm water conduit, and drains via Wetland 5B into Wetland 6, which as mentioned earlier, empties into the NAS Pensacola Yacht Basin (Wetland 64). Typical vegetation found in Wetland 5A consists of hardwoods, such as oaks and sweet bay magnolias.



Wetland 5B resembles and functions like a drainage ditch. It receives storm water from Wetland 5A and drains eastward into Wetland 6. Vegetation in Wetland 5B includes cattails (*Typha latifolia*), and other emergent plants.

IR sites potentially affecting Wetland 5 include Sites 25, 27 and 30. Site 25 (Radium Spill Site) was the location of a radium spill which occurred in 1978. Site 27 (Radium Dial Shop Sanitary Sewer) was associated with the Radium Dial Shop located in Building 709 from 1940 to 1976. Site 30 (Buildings 648, 649 and 755) was active from the 1940s through the 1970s as the NADEP Dynamic Components Division (NEESA, 1983).

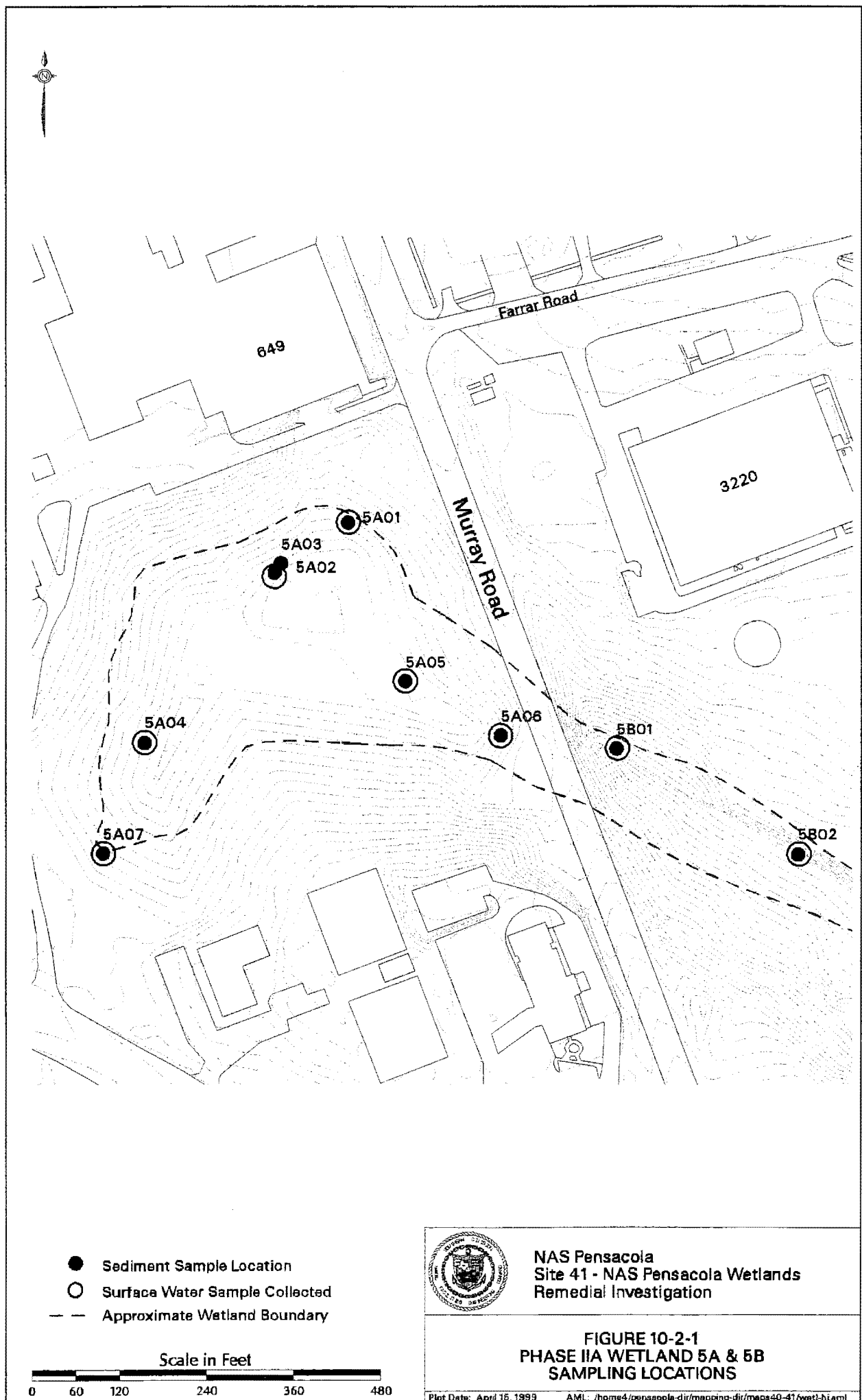
In 1994, an interim removal action (IRA) removed a contaminated former oil-water separator which was deeply buried in the sediments of Wetland 5A below Site 30. No history is available on this structure, which was discovered by USEPA investigators in 1992, and labeled a "waste receiving structure." During the IRA, the former oil-water separator and surrounding sediments were removed and disposed of, and confirmatory samples were collected from the removal area.

#### **10.2.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-2-1 denotes the Phase IIA Wetland 5A & 5B sampling locations.

#### **Wetland 5A Sediment**

Twenty-two metals were detected in Wetland 5A sediment samples. Eight metals, including cadmium (11.2 ppm, 7.6 ppm, 7.7 ppm, 4.2 ppm, and 10.1 ppm at locations 5A01, 5A02, 5A03, 5A04, and 5A05), chromium (81.1 ppm, 69.3 ppm, and 115 ppm at locations 5A01, 5A03, and 5A05), copper (156 ppm, 28.5 ppm, 68.9 ppm, and 317 ppm at locations 5A01, 5A03, 5A04, and 5A05), lead (427 ppm, 64.6 ppm, 111 ppm, 169 ppm, 383 ppm, and 48.6 ppm at locations 5A01, 5A02, 5A03, 5A04, 5A05, and 5A06), mercury (1.0 ppm, 0.37 ppm, 0.54 ppm, 0.84 ppm, and



0.25 ppm at locations 5A01, 5A03, 5A04, 5A05, and 5A06), nickel (23.5 ppm, 16 ppm, and 25.2 ppm at locations 5A01, 5A03, and 5A05), silver (1.1 ppm at location 5A02), and zinc (2,290 ppm and 591 ppm at locations 5A01 and 5A05), exceeded sediment benchmark levels at Wetland 5A. Eleven pesticides were detected in Wetland 5A sediment samples, including 4,4'-DDT and its metabolites, dieldrin, endosulfan II, endrin/endrin aldehyde/endrin ketone, alpha-BHC, and alpha/gamma-chlordane. Dieldrin (2.5 ppb and 0.85 ppb at locations 5A01 and 5A06) was detected above the sediment benchmark level (0.72 ppb) at Wetland 5A.

One 4,4'-DDE concentration (120 ppb) at location 5A05 exceeded its basewide level. The PCBs Aroclor-1254/1260 were detected in Wetland 5A sediment samples, with a single Aroclor-1260 concentration (100 ppb at location 5A05) exceeding applicable screening levels (21.6 ppb). Nineteen SVOCs were detected in Wetland 5A sediment samples, many of which were high and low molecular weight PAHs. Four different phthalate esters, 4-methylphenol, and bis(2-chloroxy)methane were also detected. Seven PAHs exceeded sediment benchmark levels, including acenaphthylene (120 ppb at location 5A05). All other PAH exceedances occurred at sample locations 5A01, 5A05, and 5A07: benzo(a)anthracene (120 ppb, 320 ppb, and 240 ppb), benzo(a)pyrene (140 ppb, 240 ppb, and 240 ppb), chrysene (180 ppb, 510 ppb, and 390 ppb), fluoranthene (280 ppb, 1,100 ppb, and 750 ppb), phenanthrene (110 ppb, 240 ppb, and 230), and pyrene (220 ppb, 730 ppb, and 620 ppb). The phthalate ester bis(2-ethylhexyl)phthalate (1,500 ppb, 690 ppb, and 1,300 ppb at locations 5A05, 5A06, and 5A07) was also detected above the appropriate screening level. Three VOCs were detected at Wetland 5A, including acetone, methylene chloride, and toluene. Acetone and methylene chloride are common laboratory contaminants. Table 10-2-1 shows the Wetland 5A Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-2-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-2-2. The HQs will be discussed further in the ecological risk section.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-2-1  
 Phase IIA Detected Concentrations in Wetland 5A Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	7/7	699 - 18700	8119.86
Antimony (Sb)	5/7	0.28 - 10	3.68
Arsenic (As)	6/7	0.78 - 3.2	2.13
Barium (Ba)	7/7	4.1 - 150	40.1
Beryllium (Be)	3/7	0.27 - 0.83	0.52
Cadmium (Cd)	7/7	0.27 - 11.2	6.0
Calcium (Ca)	7/7	351 - 71000	11046.28
Chromium (Cr)	7/7	2.8 - 115	51.63
Cobalt (Co)	6/7	0.3 - 13.4	4.92
Copper (Cu)	7/7	13.1 - 317	87.54
Iron (Fe)	7/7	616 - 9830	4682.23
Lead (Pb)	7/7	11.5 - 427	173.53
Magnesium (Mg)	7/7	27.1 - 5960	1111.83
Manganese (Mn)	7/7	11.8 - 205	58.69
Mercury (Hg)	5/7	0.25 - 1	0.60
Nickel (Ni)	6/7	1.3 - 25.2	12.3
Potassium (K)	7/7	30.3 - 413	185.27
Selenium (Se)	5/7	1.5 - 2.6	1.84
Silver (Ag)	2/7	0.42 - 1.1	0.76
Thallium (Tl)	1/7	1.4	1.4
Vanadium (V)	6/7	2.2 - 24	13.6
Zinc (Zn)	7/7	39.3 - 2290	459.27
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	5/7	0.23 - 2.3	1.10
4,4'-DDE	5/7	0.87 - 120	25.038
4,4'-DDT	3/7	0.78 - 5	2.36
Aroclor-1254	1/7	14	14
Aroclor-1260	3/7	2.6 - 100	39.53
Dieldrin	2/7	0.85 - 2.5	1.68
Endosulfan II	1/7	1.7 - 1.7	1.7
Endrin	1/7	1.1	1.1
Endrin aldehyde	1/7	0.72	0.72
Endrin ketone	1/7	0.26	0.26
alpha-BHC	2/7	0.34 - 0.64	0.49
alpha-Chlordane	2/7	0.33 - 1.6	0.97
gamma-Chlordane	2/7	0.23 - 1.3	0.77

Table 10-2-1  
 Phase IIA Detected Concentrations in Wetland 5A Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
4-Methylphenol (p-Cresol)	3/7	100 - 200	150
Acenaphthylene	1/7	120	120
Anthracene	1/7	44	44
Benzo(a)anthracene	3/7	120 - 320	226.67
Benzo(a)pyrene	4/7	37 - 240	164.25
Benzo(b)fluoranthene	3/7	57 - 360	212.33
Benzo(g,h,i)perylene	3/7	120 - 280	196.67
Benzo(k)fluoranthene	3/7	73 - 170	110.33
Butylbenzylphthalate	1/7	200	200
Carbazole	2/7	48 - 96	72
Chrysene	3/7	180 - 510	360
Di-n-butylphthalate	1/7	100	100
Di-n-octyl phthalate	1/7	22	22
Fluoranthene	5/7	71 - 1100	457.80
Indeno(1,2,3-cd)pyrene	3/7	110 - 310	203.33
Phenanthrene	3/7	110 - 240	193.33
Pyrene	5/7	71 - 730	344.8
bis(2-Chloroethoxy)methane	1/7	110	110
bis(2-Ethylhexyl)phthalate (BEHP)	3/7	690 - 1500	1163.33
<b>VOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Acetone	5/7	66 - 5200	2538
Methylene chloride	1/7	250	250
Toluene	3/7	5 - 280	131.67

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

### Wetland 5B Sediment

Twenty metals were detected at Wetland 5B sediment samples. The same eight metals that exceeded appropriate sediment benchmark levels in Wetland 5A — cadmium (220 ppm), chromium (416 ppm), copper (268 ppm), lead (481 ppm), mercury (0.68 ppm), nickel (93.9 ppm), silver (5.2 ppm), and zinc (1,160 ppm) — exceeded benchmark levels at location 5B02 in Wetland 5B. Six pesticides were detected in Wetland 5B sediment samples: 4,4-DDD/DDE, dieldrin, alpha-BHC, and alpha/gamma-chlordane. Dieldrin (7.1 ppb) was detected above its

Table 10-2-2 (1)  
**Wetland 5A**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M5A0101</b>					
	4,4'-DDD (UG/KG)	0.64	1.22	0.52	b
	4,4'-DDE (UG/KG)	0.87	2.07	0.42	b
	4,4'-DDT (UG/KG)	0.78	1.19	0.66	b
	alpha-Chlordane (UG/KG)	0.33	1.7	0.19	a
	Antimony (MG/KG)	10	12	0.83	a
	Aroclor-1260 (UG/KG)	16	21.6	0.74	b
	Arsenic (MG/KG)	2.5	7.24	0.35	a b
	Benzo(a)anthracene (UG/KG)	120	74.8	1.60	b
	Benzo(a)pyrene (UG/KG)	140	88.8	1.58	b
	Cadmium (MG/KG)	11.2	0.68	16.47	b
	Chromium (MG/KG)	81.1	52.3	1.55	a b
	Chrysene (UG/KG)	180	108	1.67	b
	Copper (MG/KG)	156	18.7	8.34	a b
	Dieldrin (UG/KG)	2.5	0.72	3.47	b
	Fluoranthene (UG/KG)	280	113	2.48	b
	Lead (MG/KG)	427	30.2	14.14	a b
	Mercury (MG/KG)	1	0.13	7.69	a b
	Nickel (MG/KG)	23.5	15.9	1.48	a b
	Phenanthrene (UG/KG)	110	86.7	1.27	b
	Pyrene (UG/KG)	220	153	1.44	b
	Zinc (MG/KG)	2290	124	18.47	a b
<b>041M5A0201</b>					
	4,4'-DDD (UG/KG)	1.5	1.22	1.23	b
	4,4'-DDE (UG/KG)	1.4	2.07	0.68	b
	Antimony (MG/KG)	2.5	12	0.21	a
	Arsenic (MG/KG)	2.5	7.24	0.35	a b
	Benzo(a)pyrene (UG/KG)	37	88.8	0.42	b
	Cadmium (MG/KG)	7.6	0.68	11.18	b
	Chromium (MG/KG)	38.9	52.3	0.74	a b
	Copper (MG/KG)	13.1	18.7	0.70	a b
	Fluoranthene (UG/KG)	71	113	0.63	b
	Lead (MG/KG)	64.6	30.2	2.14	a b
	Nickel (MG/KG)	5.8	15.9	0.36	a b
	Pyrene (UG/KG)	71	153	0.46	b
	Silver (MG/KG)	1.1	0.73	1.51	b
	Zinc (MG/KG)	39.3	124	0.32	a b
<b>041M5A0301</b>					
	4,4'-DDD (UG/KG)	0.84	1.22	0.69	b
	Arsenic (MG/KG)	2.6	7.24	0.36	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

Table 10-2-2 (2)

## Wetland 5A

## Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Cadmium (MG/KG)	7.7	0.68	11.32	b
	Chromium (MG/KG)	69.3	52.3	1.33	a b
	Copper (MG/KG)	28.5	18.7	1.52	a b
	Lead (MG/KG)	111	30.2	3.68	a b
	Mercury (MG/KG)	0.37	0.13	2.85	a b
	Nickel (MG/KG)	16	15.9	1.01	a b
	Zinc (MG/KG)	96.9	124	0.78	a b
<b>041M5A0401</b>					
	4,4'-DDD (UG/KG)	2.3	1.22	1.89	b
	4,4'-DDE (UG/KG)	1.7	2.07	0.82	b
	4,4'-DDT (UG/KG)	1.3	1.19	1.09	b
	Arsenic (MG/KG)	1.2	7.24	0.17	a b
	Cadmium (MG/KG)	4.2	0.68	6.18	b
	Chromium (MG/KG)	33.7	52.3	0.64	a b
	Copper (MG/KG)	68.9	18.7	3.68	a b
	Fluoranthene (UG/KG)	88	113	0.78	b
	Lead (MG/KG)	169	30.2	5.60	a b
	Mercury (MG/KG)	0.54	0.13	4.15	a b
	Pyrene (UG/KG)	83	153	0.54	b
	Zinc (MG/KG)	91.7	124	0.74	a b
<b>041M5A0501</b>					
	4,4'-DDE (UG/KG)	120	2.07	57.97	b
	4,4'-DDT (UG/KG)	5	1.19	4.20	b
	Acenaphthylene (UG/KG)	120	5.87	20.44	b
	alpha-Chlordane (UG/KG)	1.6	1.7	0.94	a
	Antimony (MG/KG)	4.5	12	0.38	a
	Aroclor-1260 (UG/KG)	100	21.6	4.63	b
	Arsenic (MG/KG)	3.2	7.24	0.44	a b
	Benzo(a)anthracene (UG/KG)	320	74.8	4.28	b
	Benzo(a)pyrene (UG/KG)	240	88.8	2.70	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	1500	182	8.24	b
	Cadmium (MG/KG)	10.1	0.68	14.85	b
	Chromium (MG/KG)	115	52.3	2.20	a b
	Chrysene (UG/KG)	510	108	4.72	b
	Copper (MG/KG)	317	18.7	16.95	a b
	Endrin (UG/KG)	1.1	3.3	0.33	a
	Endrin aldehyde (UG/KG)	0.72	3.3	0.22	a
	Fluoranthene (UG/KG)	1100	113	9.73	b
	gamma-Chlordane (UG/KG)	1.3	1.7	0.76	a
	Lead (MG/KG)	383	30.2	12.68	a b
	Mercury (MG/KG)	0.84	0.13	6.46	a b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

**Table 10-2-2 (3)**  
**Wetland 5A**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Nickel (MG/KG)	25.2	15.9	1.58	a b
	Phenanthrene (UG/KG)	240	86.7	2.77	b
	Pyrene (UG/KG)	730	153	4.77	b
	Zinc (MG/KG)	901	124	7.27	a b

**041M5A0701**

4,4'-DDD (UG/KG)	0.23	1.22	0.19	b
Anthracene (UG/KG)	44	46.9	0.94	b
Antimony (MG/KG)	1.1	12	0.09	a
Aroclor-1260 (UG/KG)	2.8	21.6	0.12	b
Arsenic (MG/KG)	0.78	7.24	0.11	a b
Benzo(a)anthracene (UG/KG)	240	74.8	3.21	b
Benzo(a)pyrene (UG/KG)	240	86.8	2.70	b
Bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	1300	182	7.14	b
Cadmium (MG/KG)	0.27	0.68	0.40	b
Chromium (MG/KG)	2.8	52.3	0.05	a b
Chrysene (UG/KG)	390	108	3.61	b
Copper (MG/KG)	13.1	18.7	0.70	a b
Endrin ketone (UG/KG)	0.25	3.3	0.08	a
Fluoranthene (UG/KG)	750	113	6.64	b
gamma-Chlordane (UG/KG)	0.23	1.7	0.14	a
Lead (MG/KG)	11.5	30.2	0.38	a b
Nickel (MG/KG)	2	15.9	0.13	a b
Phenanthrene (UG/KG)	230	86.7	2.65	b
Pyrene (UG/KG)	620	153	4.05	b
Zinc (MG/KG)	54.7	124	0.44	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SBVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding



sediment benchmark level (0.72 ppb) at location 5B02. No 4,4'-DDT or its metabolites exceeded basewide levels at Wetland 5B. The PCB Aroclor-1254 (53 ppb) exceeded its benchmark level (21.6 ppb) at location 5B02. Six SVOCs were detected in Wetland 5B sediment samples, including 2/4-methylphenol, benzo(b)fluoranthene, butylbenzylphthalate, fluoranthene, and pyrene. All sediment SVOC detections at Wetland 5B were below benchmark levels. Five VOCs were detected at Wetland 5B, including 1,2-dichloroethene, acetone, chlorobenzene, toluene, and vinyl chloride. Acetone and methylene chloride are common laboratory contaminants.

Table 10-2-3 shows the Wetland 5B Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-2-4 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-2-4. The HQs will be discussed further in the ecological risk section.

### **Wetland 5A Surface Water**

Sixteen metals were detected in Wetland 5A surface water samples. Seven metals, including aluminum (259 ppb, 945 ppb, 621 ppb, 206 ppb, and 153 ppb at locations 5A01, 5A02, 5A04, 5A05, and 5A07), cadmium (3.2 ppb at location 5A02), chromium (11.4 ppb at location 5A05), copper (19.6 ppb and 21.3 ppb at locations 5A05 and 5A07), iron (1,350 ppb, 1,150 ppb, 1,170 ppb, and 1,710 ppb at locations 5A01, 5A02, 5A04, and 5A05), lead (13.3 ppb, 10.5 ppb, 20.3 ppb, 10 ppb, and 2.8 ppb at locations 5A01, 5A02, 5A04, 5A05, and 5A07), and zinc (99.4 ppb, 55.8 ppb, 236 ppb, 102 ppb, and 189 ppb at locations 5A01, 5A05, 5A06, and 5A07), exceeded appropriate freshwater surface water quality criteria at Wetland 5A. Endosulfan I, was detected in surface water at Wetland 5A, below its screening criteria. No PCBs were detected in Wetland 5A surface water samples. One SVOC, bis(2-ethylhexyl)phthalate, was detected in Wetland 5A surface water above its screening level at four locations (2 ppb, 5 ppb,

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-2-3  
 Phase IIA Detected Concentrations in Wetland 5B Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	2/2	491 - 10500	5495.5
Arsenic (As)	1/2	1.3	1.3
Barium (Ba)	2/2	1.3 - 30.2	15.75
Beryllium (Be)	1/2	0.48	0.48
Cadmium (Cd)	2/2	0.3 - 220	110.15
Calcium (Ca)	2/2	109 - 4400	2254.5
Chromium (Cr)	2/2	7.9 - 416	211.95
Cobalt (Co)	1/2	5.3	5.3
Copper (Cu)	1/2	268	268
Iron (Fe)	2/2	306 - 3290	4682.23
Lead (Pb)	2/2	17.9 - 481	249.45
Magnesium (Mg)	2/2	27.1 - 668	347.55
Manganese (Mn)	2/2	1.4 - 42.7	22.05
Mercury (Hg)	1/2	0.68	0.68
Nickel (Ni)	2/2	2.2 - 93.9	48.05
Potassium (K)	2/2	10.5 - 247	128.75
Selenium (Se)	1/2	3.6	3.6
Silver (Ag)	1/2	5.2	5.2
Vanadium (V)	1/2	18.8	18.8
Zinc (Zn)	2/2	9.8 - 1160	584.9
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	1/2	2.2	2.2
4,4'-DDE	2/2	0.32 - 3.9	2.11
Aroclor-1254	2/2	8.7 - 53	30.85
Dieldrin	2/2	0.42 - 0.71	3.76
alpha-BHC	2/2	0.3 - 1.8	1.05
alpha-Chlordane	2/2	0.19 - 1.2	0.70
gamma-Chlordane	1/2	1	1
<b>SVOCs (µg/kg)</b>			
2-Methylphenol (o-Cresol)	1/2	200	200
4-Methylphenol (p-Cresol)	1/2	150	150
Benzo(b)fluoranthene	1/2	83	83
Butylbenzylphthalate	2/2	38 - 80	63
Fluoranthene	1/2	110	110
Pyrene	1/2	88	88
<b>VOCs (µg/kg)</b>			
1,2-Dichloroethene (total)	1/2	11	11
Acetone	2/2	66 - 180	123
Chlorobenzene	1/2	7	7
Toluene	1/2	13	13
Vinyl Chloride	1/2	42	42

Notes:

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-2-4 (1)  
**Wetland 5B**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>Summary</b>					
041M5B0201	4,4'-DDT (UG/KG)	2.2	1.22	1.80	b
041M5B0201	4,4'-DDE (UG/KG)	3.9	2.07	1.88	b
041M5B0201	alpha-Chlordane (UG/KG)	1.2	1.7	0.71	a
041M5B0201	Aroclor-1254 (UG/KG)	53	21.6	245	a
041M5B0201	Arsenic (MG/KG)	1.3	7.24	0.18	a b
041M5B0201	Cadmium (MG/KG)	220	0.68	323.53	b
041M5B0201	Chromium (MG/KG)	416	52.3	7.95	a b
041M5B0201	Copper (MG/KG)	268	18.7	14.33	a b
041M5B0201	Dieldrin (UG/KG)	7.1	0.72	9.86	b
041M5B0201	Fluoranthene (UG/KG)	110	113	0.97	b
041M5B0201	gamma-Chlordane (UG/KG)	1	1.7	0.59	a
041M5B0201	Lead (MG/KG)	481	30.2	15.93	a b
041M5B0201	Mercury (MG/KG)	0.88	0.13	5.23	a b
041M5B0201	Nickel (MG/KG)	93.9	15.8	5.91	a b
041M5B0201	Pyrene (UG/KG)	88	153	0.58	b
041M5B0201	Silver (MG/KG)	5.2	0.73	7.12	b
041M5B0201	Zinc (MG/KG)	1160	124	9.35	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding

3 ppb, and 2 ppb at locations 5A01, 5A04, 5A05, and 5A06). Six VOCs were detected in Wetland 5A surface water, including 1,1-dichloroethane, cis-1,2-dichloroethene, acetone, bromodichloroethane, chloroform, and dibromochloromethane. No VOCs detected in Wetland 5A surface water samples exceeded any surface water quality standard. Acetone is a common laboratory contaminant.

Table 10-2-5 shows the Wetland 5A Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-2-6 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with water quality criteria are presented in Table 10-2-6. The HQs will be further discussed in the ecological risk section.

#### **Wetland 5B Surface Water**

Sixteen metals were also detected in Wetland 5B surface water. Eight metals, including aluminum (2,060 ppb), cadmium (19 ppb), chromium (40.8 ppb), copper (52.7 ppb), iron (2,890 ppb), lead (94.1 ppb), mercury (0.14 ppb) and zinc (189 ppb), exceeded freshwater surface water quality criteria at location 5B02. No pesticides or PCBs were detected in Wetland 5B surface water. Five SVOCs, were detected in Wetland 5B surface water, including 2-chlorophenol, 4-chloro-3-methylphenol, n-nitroso-di-n-propylamine, pyrene, and bis(2-ethylhexyl)phthalate. Bis(2-ethylhexyl)phthalate exceeded its surface water screening criteria at location 5B02 (2 ppb). Four VOCs were detected in Wetland 5B surface water, including 1,1-dichloroethane, acetone, trichloroethene, and vinyl chloride. No VOCs detected in Wetland 5B surface water samples exceeded any surface water quality standard. Acetone is a common laboratory contaminant.

Table 10-2-7 shows the Wetland 5B Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-2-8 compares detected concentrations at each sample location to surface water quality criteria, and lists calculated HQs for each parameter. Only the parameters with water quality criteria are presented in Table 10-2-8. The HQs will be further discussed in the ecological risk section.

**Table 10-2-5**  
**Phase IIA Detected Concentrations in Wetland 5A Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	5/6	153 - 945	436.8
Antimony (Sb)	1/6	3.1	3.1
Barium (Ba)	6/6	13.6 - 41.4	26.62
Cadmium (Cd)	1/6	3.2	3.2
Calcium (Ca)	6/6	5460 - 28600	15643.33
Chromium (Cr)	1/6	11.4	11.4
Cobalt (Co)	1/6	3	3
Copper (Cu)	3/6	7.2 - 21.3	16.03
Iron (Fe)	6/6	357 - 1710	1114.5
Lead (Pb)	5/6	2.8 - 20.3	11.38
Magnesium (Mg)	6/6	2090 - 6710	3301.67
Manganese (Mn)	6/6	20.5 - 80	48.57
Potassium (K)	6/6	1050 - 5580	2665
Sodium (Na)	6/6	7710 - 21300	12238.33
Thallium (Tl)	1/6	3.5	3.5
Zinc (Zn)	4/6	55.8 - 236	123.3
<b>Pesticides and PCBs (<math>\mu\text{g/L}</math>)</b>			
Endosulfan I	1/6	0.029	0.029
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
bis(2-ethylhexyl)phthalate	4/6	2 - 5	3
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
1,1-Dichloroethane	1/6	1	1
cis-1,2-Dichloroethene	1/6	1	1
Acetone	1/1	9	9
Bromodichloromethane	1/6	2	2
Chloroform	1/6	1	1
Dibromochloromethane	1/6	2	2

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-2-6 (1)  
Wetland 5A  
Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UDM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W5A0101	Freshwater					
Aluminum	UG/L	945.0	87.0	10.86207	a	
Cadmium	UG/L	3.2	0.774	4.13437	a b	
Iron	UG/L	1,150.0	1,000.0	1.15	a b	
Lead	UG/L	10.5	1.71	6.14036	a b	
041W5A0201	Freshwater					
Aluminum	UG/L	945.0	87.0	10.86207	a	
Cadmium	UG/L	3.2	0.774	4.13437	a b	
Iron	UG/L	1,150.0	1,000.0	1.15	a b	
Lead	UG/L	10.5	1.71	6.14036	a b	
041W5A0401	Freshwater					
Aluminum	UG/L	621.0	87.0	7.13793	a	
bis(2-Ethylhexyl)phthalate (BEHP)	UG/KG	5.0	0.3	16.66667	a	
Iron	UG/L	1,170.0	1,000.0	1.17	a b	
Lead	UG/L	20.3	1.71	11.87134	a b	
041W5A0501	Freshwater					
Aluminum	UG/L	206.0	87.0	2.36782	a	
Antimony	UG/L	3.1	160.0	0.01938	a	
bis(2-Ethylhexyl)phthalate (BEHP)	UG/L	1.0	0.3	10.0	a	
Chromium	UG/L	11.1	11.0	1.03636	a b	
Copper	UG/L	19.6	7.8	2.51282	a b	
Iron	UG/L	1,710.0	1,000.0	1.71	a b	
Lead	UG/L	10.0	1.71	5.84795	a b	
Zinc	UG/L	55.8	70.2	0.79487	a b	
041W5A0601	Freshwater					
bis(2-Ethylhexyl)phthalate (BEHP)	UG/L	2.0	0.3	6.66667	a	
Chloroform	UG/L	1.0	289.0	0.00346	a	
Copper	UG/L	7.2	7.8	0.92308	a b	
Iron	UG/L	357.0	1,000.0	0.357	a b	
Zinc	UG/L	236.0	70.2	3.36192	a b	

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class II Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding

Table 10-2-6 (2)  
Welland 5A  
Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
Welland 5A	Phosphorus	mg/L	0.0000	0.0000	0.0000	(a)
Welland 5A	Phosphorus	mg/L	0.0000	0.0000	0.0000	(b)

Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1995)

Some of the numbers in the table may vary because of rounding

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-2-7  
 Phase IIA Detected Concentrations in Wetland 5B Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	2060	2060
Barium (Ba)	1/1	27.8	27.8
Cadmium (Cd)	1/1	19	19
Calcium (Ca)	1/1	15600	15600
Chromium (Cr)	1/1	40.8	40.8
Cobalt (Co)	1/1	3.9	3.9
Copper (Cu)	1/1	52.7	52.7
Iron (Fe)	1/1	2890	2890
Lead (Pb)	1/1	94.1	94.1
Magnesium (Mg)	1/1	3250	3250
Manganese (Mn)	1/1	109	109
Mercury (Hg)	1/1	0.14	0.14
Potassium (K)	1/1	2160	2160
Sodium (Na)	1/1	12600	12600
Vanadium (V)	1/1	5.2	5.2
Zinc (Zn)	1/1	189	189
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
2-Chlorophenol	1/1	1	1
4-Chloro-3-methylphenol	1/1	1	1
N-nitroso-di-n-propylamine	1/1	1	1
Pyrene	1/1	2	2
Bis(2-ethylhexyl)phthalate	1/1	2	2
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
1,1-Dichloroethane	1/1	3	3
Acetone	1/1	8	8
Trichloroethene	1/1	10	10
Vinyl Chloride	1/1	6	6

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).



Table 10-2-8 (1)  
**Wetland 5B**  
**Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W5B0201</b>	<b>Freshwater</b>					
	2-Chlorophenol	UG/L	1.0	43.8	0.02283	a
	4-Chloro-3-methylphenol	UG/L	1.0	50.0	0.02	b
	Aluminum	UG/L	2,060.0	87.0	23.67816	a
	bis(2-Ethylhexyl)phthalate (BEHP)	UG/L	2.0	0.3	6.66667	a
	Cadmium	UG/L	19.0	0.774	24.5478	a b
	Chromium	UG/L	40.8	11.0	3.70909	a b
	Copper	UG/L	52.7	7.8	6.75641	a b
	Iron	UG/L	2,890.0	1,000.0	2.89	a b
	Lead	UG/L	94.1	1.71	55.02924	a b
	Mercury	UG/L	0.14	0.012	11.66667	a b
	Pyrene	UG/L	2.0	11,000.0	0.00018	b
	Trichloroethene	UG/L	10.0	80.7	0.12392	b
	Zinc	UG/L	189.0	70.2	2.69231	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### 10.2.3 Fate and Transport

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data are lacking, the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-2-9 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Tables 10-2-6 and 10-2-8.

Table 10-2-9  
 Calculated Sediment Screening Values for Wetland 5

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganic</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Cadmium	0.774 <sup>a, b</sup>	7.5E+01	5.82	220	YES
Chromium	11 <sup>a, b</sup>	1.9E+01	21	416	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	336	317	NO
Lead	1.71 <sup>a, b</sup>	9E+02	154	481	YES
Mercury	0.012 <sup>a, b</sup>	5.2E+01	0.0624	1	YES
Nickel	104 <sup>a, b</sup>	6.5E+01	677	93.9	NO
Zinc	70.2 <sup>a, b</sup>	6.2E+01	436	2290	YES
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	10.5 <sup>a</sup>	5.14E+05	5.39E+08	120	NO
4,4 DDD	0.0064 <sup>a</sup>	1.15E+05	7.36E+04	2.3	NO
4,4 DDT	0.001 <sup>a, b</sup>	3.02E+05	3.02E+03	5	NO
Dieldrin	0.0019 <sup>a, b</sup>	2.46E+03	4.68E+02	7.1	NO
Acenaphthylene	0.031 <sup>b</sup>	356.5	1,105	120	NO
Total PCBs*	0.014 <sup>b</sup>	3.55E+04	4.97E+04	153	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	45,770	141,887	320	NO
Chrysene	0.031 <sup>b</sup>	45,770	141,887	510	NO
Fluoranthene	39.8 <sup>a</sup>	12,305	4.9E+07	1,100	NO
Phenanthrene	0.031 <sup>b</sup>	3,540	10,695	240	NO

Table 10-2-9  
 Calculated Sediment Screening Values for Wetland 5

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Pyrene	11,000 <sup>b</sup>	1.2E+04	1.32E+10	730	NO
Bis(2-ethylhexyl)phthalate	0.3 <sup>a</sup>	1.74E+06	5.22E+07	1,500	NO

**Notes:**

\* = based on Aroclor-1260.

Kd for organics calculated using foc of 0.115 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix(USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Criteria (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## Transport Within the Wetland

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Wetland 6, and from there to Wetland 64 and the Bayou Grande. Therefore, both sediment and surface water contaminants can remain mobile.

### *Sediment Leaching to Surface Water Pathway:*

Seven inorganics, four pesticides, four SVOCs, three VOCs, and PCBs (see Table 10-2-9) exceeded their SSV, but only five – cadmium, chromium, lead, mercury, and zinc exceeded their SSL. Of these six, all but chromium were present in the corresponding surface water above standards, validating the sediment leaching pathway. Iron was also present in surface water above standards, but it is likely attributable to the surface water/groundwater discharge pathway. The presence of inorganics above screening levels in sediment and surface water indicates a high potential for partitioning from sediment to surface water.

## Transport From the Wetland

Surface water and sediment can be expected to move from Wetland 5 into Wetlands 6 and 64, and into Bayou Grande.

#### **10.2.4 Ecological Risk Assessment**

HQs for Wetlands 5A and 5B sediment samples are presented in Tables 10-2-2 and 10-2-4. For Wetland 5A, Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for cadmium (16.47, 11.8, 11.32, 6.18, and 14.85 at locations 5A01, 5A02, 5A03, 5A04, and 5A05), chromium (1.55, 1.33, and 2.20 at locations 5A01, 5A03, and 5A05), copper (8.34, 1.52, 3.68, and 16.95 at locations 5A01, 5A03, 5A04, and 5A05), lead (14.14, 2.14, 3.68, 5.60, 12.68, and 1.61 at locations 5A01, 5A02, 5A03, 5A04, 5A05, and 5A06), mercury (7.69, 2.85, 4.15, 6.46, and 1.92 at locations 5A01, 5A03, 5A04, 5A05, and 5A06), nickel (1.48, 1.01, and 1.58 at locations 5A01, 5A03, and 5A05), silver (1.51 at location 5A02), and zinc (18.47 and 4.77 at locations 5A01 and 5A05). Dieldrin also had a HQ above 1 (3.47 and 1.18 at locations 5A01 and 5A06). 4,4'-DDD had HQs greater than 1 at sample locations 5A02 (1.23) and 5A04 (1.89). 4,4'-DDE had a HQ above 1 (57.97) at location 5A05. 4,4'-DDT had HQs above 1 at locations 5A04 (1.09) and 5A05 (4.20). Most concentrations of 4,4'-DDT and its metabolites were below basewide levels. The PCB Aroclor-1260 had a HQ above 1 at location 5A05 (4.63). Acenaphthylene had a HQ above 1 (20.44) at location 5A05. Other PAHs with HQs above 1 occurred at sample locations 5A01, 5A05, and 5A07: benzo(a)anthracene (1.60, 4.28, and 3.21), benzo(a)pyrene (1.58, 2.70, and 2.70), chrysene (1.67, 4.72, and 3.61), fluoranthene (2.48, 9.73, and 6.64), phenanthrene (1.27, 2.77, and 2.65), and pyrene (1.44, 4.77, and 4.05). The phthalate ester bis(2-ethylhexyl)phthalate also had a HQ greater than 1 (8.24, 3.79, and 7.14 at locations 5A05, 5A06, and 5A07). For Wetland 5B, Phase IIA sediment comparisons revealed HQs above 1 for cadmium (323.53), chromium (7.95), copper (14.33), lead (15.93), mercury (5.23), nickel (5.91), silver (7.12), and zinc (9.35). 4,4'-DDD and 4,4'-DDE had HQs greater than 1 at sample location 5B02 (1.80 and 1.88). Dieldrin also had a HQ above 1 (9.86) at location 5B02, as did the PCB Aroclor-1254 (2.45). Wetland 5A Phase IIA surface water results revealed HQs greater than 1 for aluminum (2.98, 10.86, 7.14, 2.37, and 1.76 at locations 5A01, 5A02, 5A04, 5A05, and 5A07), cadmium (4.13 at location 5A02), chromium (1.04 at location 5A05), copper (2.51 and 2.73 at

locations 5A05 and 5A07), iron (1.35, 1.15, 1.17, and 1.71 at locations 5A01, 5A02, 5A04, and 5A05), lead (7.78, 6.14, 11.87, 5.85, and 1.64 at locations 5A01, 5A02, 5A04, 5A05, and 5A07), and zinc (1.42, 0.79, 3.36, 1.45, and 2.69 at locations 5A01, 5A05, 5A06, and 5A07), exceeded appropriate freshwater surface water quality criteria at Wetland 5A. Only one pesticide, endosulfan I, was detected in surface water at Wetland 5A, below the screening criteria. No PCBs were detected in Wetland 5A surface water samples. One SVOC, bis(2-ethylhexyl)phthalate, was detected in Wetland 5A surface water above its screening level at four locations (6.67, 16.67, 10, and 6.67 at locations 5A01, 5A04, 5A05, and 5A06). Wetland 5B Phase IIA surface water results revealed HQs greater than 1 for aluminum (23.68), cadmium (24.55), chromium (3.71), copper (6.76), iron (2.89), lead (55.03), mercury (11.67) and zinc (2.69) at location 5B02. Bis(2-ethylhexyl)phthalate also had a HQ greater than 1 at location 5B02 (6.67). HQs greater than 1 indicate the potential for excess risk.

### **Phase IIB/III**

Wetland 5A was classified in Group B and sampled during Phase IIB/III. Wetland 5B was classified with Group D. The Group D wetlands appear as man-made drainage ditches and are in developed areas of the base. Due to their channelized features and proximity to developed areas, they have limited ecological receptors. The Group D wetlands were eliminated for further risk characterization and were therefore not sampled during Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

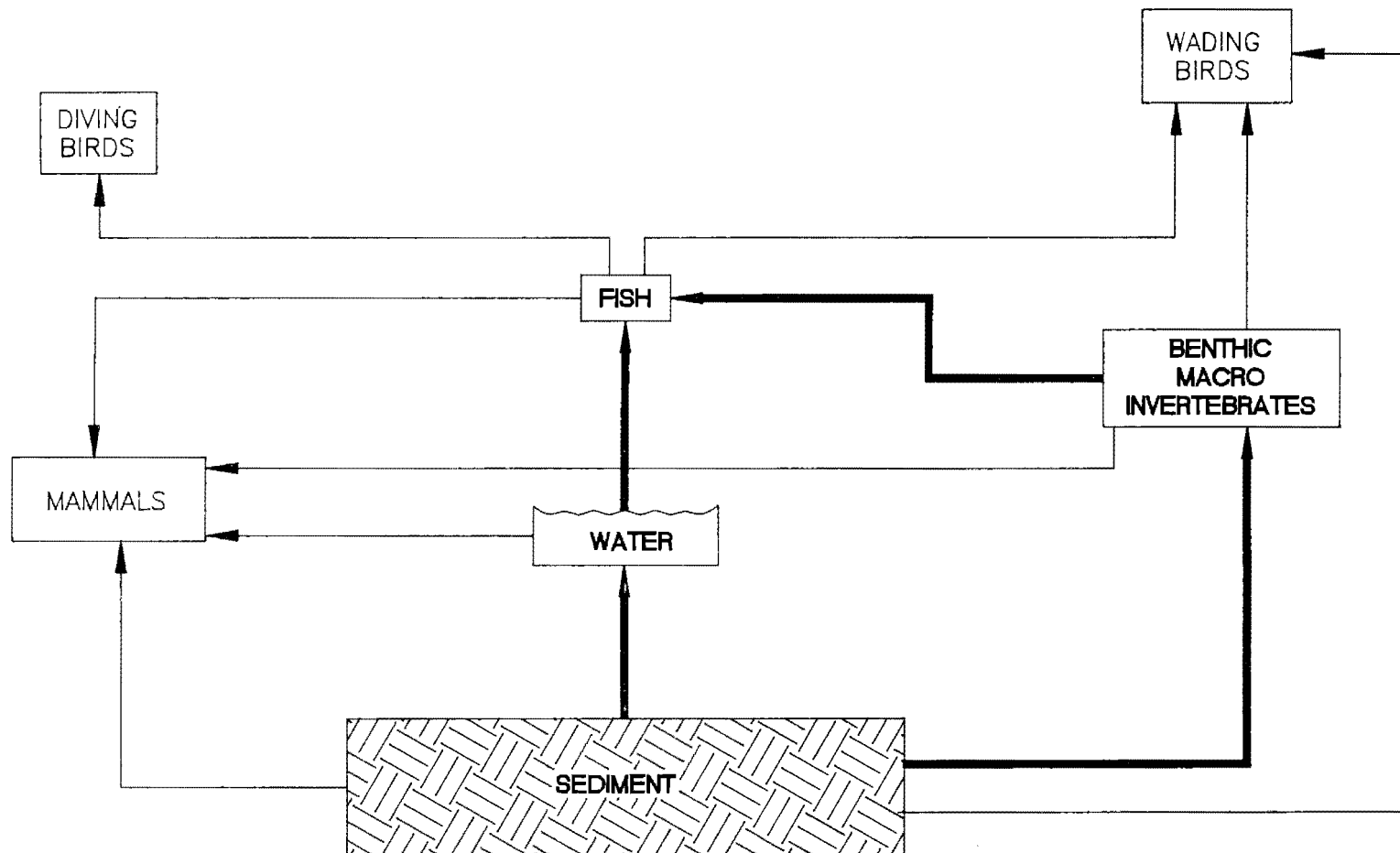
### **Conceptual Model**

Conceptual models demonstrate contaminant interaction throughout the food chain and help in selecting receptor species. Selected receptor species are referred to as measurement and assessment endpoint species. Measurement endpoints, defined in Section 7.5, are used to quantify direct impacts to those species chosen in the conceptual model. Assessment endpoints, also defined in Section 7.5, are used to predict impacts to other species in the conceptual model not directly measured. The conceptual model developed for Group B: Wetland 5A is shown in Figure 10-2-2.

Freshwater Wetland 5A is fed by surface water and groundwater sources at its western side and is bordered by Site 30. There is a 200- to 300-foot vegetative buffer surrounding the wetland which can provide habitat and cover for many species. The open water portion of this wetland ranges from 0 to 3 feet in depth, and varies from 80-150 feet in width. Great blue herons have been seen in this wetland. Small fish and benthic macroinvertebrates have also been seen in this wetland, but this habitat is considered highly variable because of regular changes in water levels due to precipitation and other physical factors. The primary functional uses of this wetland are as habitat for a fisheries and benthic macroinvertebrates. However, this wetland is not considered large enough to support higher trophic level fish species. No higher trophic level fish species have been seen in Wetland 5A. A wide range of contaminants have been detected in this wetland, including metals, PAHs, pesticides, and PCBs. However, the most prevalent contaminants from the Phase IIA analysis were metals, which are primarily a concern from a direct toxicity perspective. Therefore, the conceptual model in Figure 10-2-2 focuses on benthic macroinvertebrates and fish exposed to metal-contaminated sediment.

### **Sampling Location Rationale**

Phase IIB/III samples for sediment and surface water samples toxicity analysis, sediment chemistry, TOC, and grain size were collected from Phase IIA locations 4, 5, and 6. These locations were selected to represent a concentration gradient across the wetland. Phase IIB/III sample locations are shown on Figure 10-2-3. Three composite grab samples for benthic diversity were collected within 10 feet of each sample location to account for spatial variability. As a channelized drainage ditch with limited receptors, Wetland 5B was removed from further sampling and analysis. Three surface water samples were collected from Wetland 5A for chemical analysis and fathead minnow (*Pimephales promelas*) toxicity analysis.



NOTE: BOLD LINES INDICATE  
COMPLETE PATHWAY



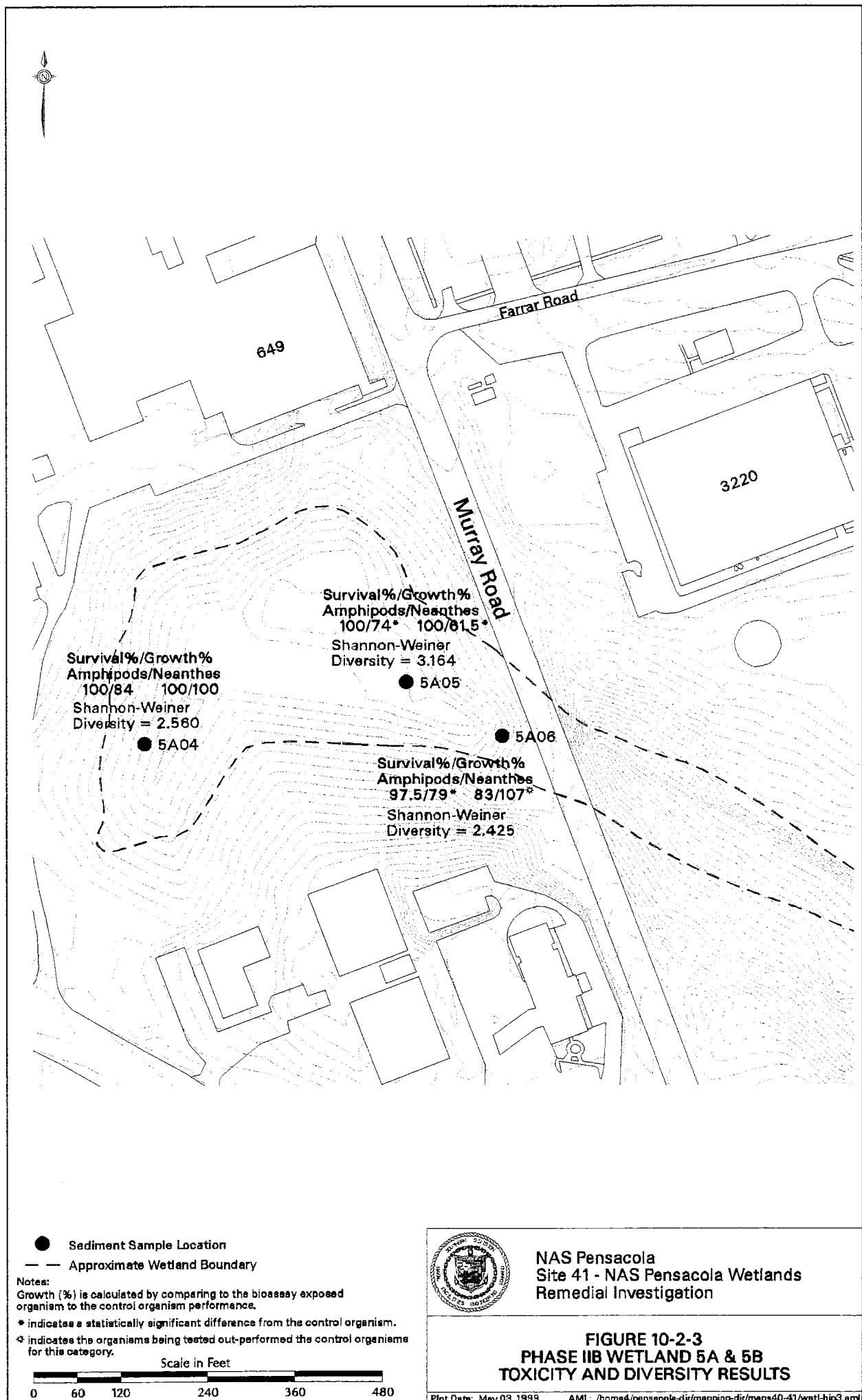
SITE 41 RI REPORT  
NAVAL AIR STATION PENSACOLA  
PENSACOLA, FLORIDA

FIGURE 10-2-2  
GROUP B: WETLAND 5A  
CONCEPTUAL MODEL

DWG DATE: 03/11/99 | DWG NAME: 0036S013

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## Ecological Risk Evaluation

Risk in Wetland 5A was evaluated with respect to two assessment endpoints: 1) survival and growth of macroinvertebrates associated with the benthic environment, and 2) protection of fish viability.

### Survival, Growth, and Emergence of Organisms Associated with the Aquatic Environment:

As described in Section 7.14, this assessment endpoint was evaluated using the sediment quality triad approach (sediment chemistry, toxicity, and diversity). Table 10-2-10 compares detected Phase IIB/III sediment concentrations to benchmark levels, and lists calculated HQs for each parameter. DDT and its metabolites are also compared to basewide levels (see Section 6). As shown on the tables, sediment HQ values are greater than one for a range of contaminants. At location, 5A04, alpha-chlordane, fluoranthene, and gamma-chlordane were the greatest contributors. At location 5A05, bis(2-ethylhexyl)phthalate, cadmium and lead were the greatest contributors. DDT and its metabolites were detected below their basewide levels. Application of these sediment chemistry results to the decision making triad revealed a matrix score of “+” for sediment chemistry.

### Sediment Toxicity

Survival results in the *Chironomus tentans* test were 100% for location 5A-04, 100% for location 5A05, and 83% for location 5A06, as presented in Table 10-2-11. Statistical difference were noted in the weights collected at the end of the 10-day exposure (locations 5A04 2.6 mg, 5A05 1.6 mg, and 5A06 2.8 mg when compared to the control 2.6 mg). Midge larvae were maintained under optimum conditions for the next 18 days so emergence could be calculated. 60% of the control larvae emerged, 75% of the larvae from location 5A04 emerged, 50% of the larvae from location 5A05 emerged, and 75% of the larvae from location 5A06 emerged. Application of these results to the decision making triad revealed a triad matrix score of “—” for the toxicity test.

Table 10-2-10 (1)  
Wetland 5A  
Phase IIB/III Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M5A0401</b>					
	4,4'-DDT (UG/KG)	7.2	1.19	6.05	b
	alpha-Chlordane (UG/KG)	4.5	1.7	2.65	a
	Anthracene (UG/KG)	16	46.9	0.34	b
	Arsenic (MG/KG)	0.52	7.24	0.07	a b
	Benzo(a)anthracene (UG/KG)	100	74.8	1.34	b
	Benzo(a)pyrene (UG/KG)	140	88.8	1.58	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	210	182	1.15	b
	Cadmium (MG/KG)	0.42	0.68	0.62	b
	Chromium (MG/KG)	4.1	52.3	0.08	a b
	Chrysene (UG/KG)	170	108	1.57	b
	Copper (MG/KG)	21.5	18.7	1.15	a b
	Fluoranthene (UG/KG)	260	113	2.30	b
	gamma-BHC (Lindane) (UG/KG)	0.24	0.32	0.75	b
	gamma-Chlordane (UG/KG)	7.9	1.7	4.65	a
	Lead (MG/KG)	54.5	30.2	1.80	a b
	Mercury (MG/KG)	0.13	0.13	1.00	a b
	Nickel (MG/KG)	2.5	15.9	0.16	a b
	Phenanthrene (UG/KG)	97	86.7	1.12	b
	Pyrene (UG/KG)	300	153	1.96	b
	Zinc (MG/KG)	77.1	124	0.62	a b
<b>041M5A0501</b>					
	Antimony (MG/KG)	27.7	12	2.31	a
	Benzo(a)anthracene (UG/KG)	41	74.8	0.55	b
	Benzo(a)pyrene (UG/KG)	52	88.8	0.59	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	950	182	5.22	b
	Cadmium (MG/KG)	3.2	0.68	4.71	b
	Chromium (MG/KG)	50.1	52.3	0.96	a b
	Chrysene (UG/KG)	58	108	0.54	b
	Copper (MG/KG)	108	18.7	5.78	a b
	Fluoranthene (UG/KG)	72	113	0.64	b
	Lead (MG/KG)	258	30.2	8.54	a b
	Mercury (MG/KG)	0.09	0.13	0.69	a b
	Nickel (MG/KG)	7.5	15.9	0.47	a b
	Phenanthrene (UG/KG)	28	86.7	0.32	b
	Pyrene (UG/KG)	87	153	0.57	b
	Silver (MG/KG)	0.15	0.73	0.21	b
	Zinc (MG/KG)	394	124	3.18	a b
<b>041M5A0601</b>					
	4,4'-DDD (UG/KG)	1.3	1.22	1.07	b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding.

Table 10-2-10 (2)  
**Wetland 5A**  
**Phase IIB/III Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	4,4'-DDE (UG/KG)	3.6	2.07	1.74	b
	4,4'-DDT (UG/KG)	3.2	1.19	2.69	b
	Antimony (MG/KG)	2	12	0.17	a
	Cadmium (MG/KG)	1.2	0.68	1.76	b
	Chromium (MG/KG)	24.4	52.3	0.47	a b
	Copper (MG/KG)	25.6	18.7	1.37	a b
	Dieldrin (UG/KG)	1.4	0.72	1.94	b
	Endrin (UG/KG)	1.1	3.3	0.33	a
	Fluoranthene (UG/KG)	16	113	0.14	b
	Lead (MG/KG)	75.5	30.2	2.50	a b
	Mercury (MG/KG)	0.06	0.13	0.46	a b
	Nickel (MG/KG)	1.8	15.9	0.11	a b
	Zinc (MG/KG)	103	124	0.83	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

Table 10-2-11  
 Toxicity Test Results  
 Wetland 5 Sediment

Site	% Survival	Weight (mg)	Emergence	Triad Matrix Scoring
Control (negative)	100	2.6	60%	
Wetland 5 (5A-04)	100	2.6	75%	—
Wetland 5 (5A-05)	100	1.6*	50%	—
Wetland 5 (5A-06)	83	2.8*	75%	—

**Note:**

\* = Statistically significant difference from control population.

### Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. Sample locations 5A04, 5A05, and 5A06 contained a diverse representation of palustrine organisms. Sample location 5A04 was dominated by *Limnodrilus* species and *Tubifex tubifex*, both of which are oligochaetes. Location 5A05 exhibited a higher diversity (3.16), than locations 5A04 (2.56), and 5A06 (2.43). Benthic diversity results and application to the toxicity test results are presented in Table 10-2-12. Application of these results to the decision making triad revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-2-12  
 Benthic Diversity Results and Application to the Triad Matrix  
 Wetland 5 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 5 (5A-04)	2.56	1.11	9.76	—
Wetland 5 (5A-05)	3.16	1.37	9.74	—
Wetland 5 (5A-06)	2.43	1.25	6.88	—

### Decision Making Triad Evaluations

Based on the ecological risk evaluation performed at Wetland 5, sediment results can be scored via the decision making triad, and the overall condition of the wetland for sediment can be

determined. Table 10-2-13 presents the interpretation of the triad analysis for the Wetland 5 Phase IIB/III sediment samples.

Table 10-2-13  
 Triad Analysis Interpretation  
 Wetland 5 Sediment

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 5 (5A-04)	+	—	—	Contaminants are not bioavailable.
Wetland 5 (5A-05)	+	—	—	Contaminants are not bioavailable.
Wetland 5 (5A-06)	+	—	—	Contaminants are not bioavailable.

Condition number 3 denotes that Wetland 5 sediments are acceptable and no further action is recommended for sediment for this wetland. Based on the results of the chemistry and toxicity data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

#### Protection of Fish Viability:

This assessment endpoint was evaluated using two lines of evidence. Direct comparison of tissue residue concentrations to toxic effects thresholds, was not evaluated in Wetland 5A because the shallow water depth does not support upper trophic level species.

#### Surface Water Toxicity

One line of evidence was toxicity testing of the fathead minnow (*Pimephales promelas*). The endpoints for this test were survival and growth, which is measured by weight. Fathead minnow test results were 97.5% survival for the fish exposed to location 5A06, and 100% survival for fish at locations 5A04 and 5A05 including control organisms. Weights differed slightly, with a statistically significant difference noted for fish exposed to locations 5A05 (0.43 mg) and location 5A06 (0.46) when compared to fatheads exposed to location 5A04 (0.49 mg) and the control (0.58 mg). Toxicity results are shown in Table 10-2-14. Application of these results to

the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the fathead minnow test.

Table 10-2-14  
 Fathead Minnow Chronic Bioassay Results  
 Wetland 5 Surface Waters

Location	% Survival	Weight (mg)	Matrix Scoring
Control (negative)	100	0.58	+
Wetland 5 (5A-04)	100	0.49	—
Wetland 5 (5A-05)	100	0.43*	—
Wetland 5 (5A-06)	97.5	0.46*	—


**Note:**

\* = Statistically significant difference from control population.

### Surface Water Chemistry

A second line of evidence, comparison of surface water contaminants to HQ values, shows that the HQ value of 1 was exceeded for several metals, particularly lead. Comparisons are provided in Table 10-2-15. Application of surface water chemistry results to the decision making matrix revealed a score of “+” for surface water chemistry. Table 10-2-16 presents the interpretation of the analysis for the Wetland 5 surface water sample. Based on the results of the chemistry and toxicity data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Surface Water, as discussed in Figure 7-3. Condition number 3 denotes that Wetland 5 surface water is acceptable and no further action is recommended for surface water for this wetland.

**Table 10-2-15 (1)**  
**Wetland 5A**  
**Phase IIB/III Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W5A0401</b>	<b>Freshwater</b>					
Aluminum		UG/L	124.00	87.00	1.43	a
Copper		UG/L	4.10	7.80	0.53	a,b
Iron		UG/L	755.00	1000.00	0.75	a,b
Lead		UG/L	9.00	1.71	5.28	a,b
Zinc		UG/L	23.20	70.20	0.33	a,b
						
<b>041W5A0601</b>	<b>Freshwater</b>					
Aluminum		UG/L	124.00	87.00	1.43	a
Iron		UG/L	2500.00	1000.00	2.50	a,b
Zinc		UG/L	15.40	70.20	0.22	a,b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.



Table 10-2-16  
Matrix Analysis Interpretation  
Wetland 5 Surface Water

Location	Water Chemistry	Toxicity Test	Interpretation
Wetland 5 (5A-04)	+	—	Contaminants are not bioavailable.
Wetland 5 (5A-05)	+	—	Contaminants are not bioavailable.
Wetland 5 (5A-06)	+	—	Contaminants are not bioavailable.

## 10.2.5 Human Health Risk Assessment

### 10.2.5.1 Samples Included

#### Sediment

041M5A0101, 041M5A0201, 041M5A0301, 041M5A0401, 041M5A0501, 041M5A0601, 041M5A0701, 041M5B0101, 041M5B0201

#### Surface Water

041W5A0101, 041W5A0201, 041W5A0401, 041W5A0501, 041W5A0601, 041W5A0701, 041W5B0201

### 10.2.5.2 Current and Future Land Use

The area may be used by Navy and civilian personnel who happen to be in the area for work related duties or children who find the area attractive. No routine grounds maintenance activities have been reported in this area, therefore, the maintenance worker scenario was not included in this risk assessment. There is no recreational or fishing use. The adolescent trespasser scenario was considered conservatively representative of potential exposure populations for this wetland.

### 10.2.5.3 Fish COPCs Identified

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.2.5.4 Sediment COPCs Identified**

As shown in Table 10-2-17, the following COPC was identified:

- Lead

#### **10.2.5.5 Surface Water COPCs Identified**

As shown in Table 10-2-18, the following COPCs were identified:

- Lead
- Vinyl chloride

#### **10.2.5.6 Risk Characterization**

##### ***Adolescent Trespasser***

Table 10-2-19 summarizes risk estimates for the surface water pathways. Vinyl chloride was the only contributor to risk estimates for the surface water pathway. The cumulative risk estimated for this wetland is  $1.9E-6$ . Vinyl chloride was identified as a COC for surface water based on its contribution to cumulative risk estimates for this wetland.

##### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 5. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 5 sediment and surface water was considered additional to those they typically encountered at the child's home.

TABLE 10-2-17  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario: Fumigation - Control and Isolation  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetlands and 50  
Backbay

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Uses	Location of Maximum Concentration	Detection Frequency	Range of Detection Levels	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRC	(5) Residential Soil RSC	Potential ARAR/BC Source	COPC Flag	Rationale for Concerns Detection or Selection
545504	1,2-Dichloroethane (Total)	11.00	J	11.00	J	UG/KG	D41MSA0201	1 / 1 / 9	12.00 - 83.03	11.00	11	N/A	2800000	70000	N/A	NO	BSL
55497	2-Methylphenol (o-Cresol)	200.00	J	200.00	J	UG/KG	D41MSA0201	1 / 1 / 9	400.00 - 1900.00	200.00	200	N/A	16000000	390000	N/A	NO	BSL
72548	4,4'-DDD	0.23	J	2.30	J	UG/KG	D41MSA0401	6 / 1 / 9	0.21 - 0.81	1.29	2.3	N/A	82000	2700	C	N/A	BSL
72552	4,4'-DDE	0.32	J	120.00	DU	UG/KG	D41MSA0501	7 / 1 / 9	0.20 - 0.61	18.48	120	N/A	65000	1900	C	N/A	BSL
50293	4,4'-DDT	0.78	J	5.00	J	UG/KG	D41MSA0501	3 / 1 / 9	0.20 - 0.73	2.38	5	N/A	85000	1900	C	N/A	BSL
105445	4-Methylphenol (p-Cresol)	120.00	J	200.00	J	UG/KG	D41MSA0201	4 / 1 / 9	400.00 - 1200.00	150.00	200	N/A	1600000	36000	C	N/A	BSL
208950	Acephenylene	120.00	J	120.00	J	UG/KG	D41MSA0501	1 / 1 / 9	40.00 - 140.00	120.00	120	N/A	12000000	470000	N/A	NO	BSL
87541	Aceitone	68.00	J	5200.00	J	UG/KG	D41MSA0101	7 / 1 / 9	13.00 - 130.00	1719.43	5700	N/A	32000000	7900000	N/A	NO	BSL
120127	Aethacene	44.00	J	44.00	J	UG/KG	D41MSA0701	1 / 1 / 9	63.00 - 1400.00	44.00	44	N/A	95000000	2300000	N/A	NO	BSL
7440380	Arsimony (Se)	0.78	J	10.00	J	MG/KG	D41MSA0501	5 / 1 / 9	0.14 - 4.40	3.88	10	N/A	130	3.1	N/A	NO	BSL
11097601	Aroclor-1254	8.70	J	53.90	J	MG/KG	D41MSA0201	3 / 1 / 9	2.00 - 8.10	25.23	53	N/A	11000	150	C	N/A	BSL
11098925	Aroclor-1240	2.60	J	100.00	J	MG/KG	D41MSA0401	3 / 1 / 9	3.20 - 14.00	30.63	100	N/A	11000	320	C	N/A	BSL
7443382	Arsenic (As)	0.78	J	3.20	J	MG/KG	D41MSA0201	7 / 1 / 9	0.14 - 0.15	2.01	3.2	N/A	15	0.43	C	N/A	BSL
56585	Benzol(a)anthracene	120.00	J	320.00	J	UG/KG	D41MSA0501	3 / 1 / 9	41.00 - 140.00	226.87	320	N/A	30000	890	C	N/A	BSL
50129	Benzol(a)pyrene	37.00	J	240.00	J	UG/KG	D41MSA0501	4 / 1 / 9	41.00 - 140.00	154.25	240	N/A	3000	86	C	N/A	BSL
705992	Benzol(h)fluoranthene	57.00	J	360.00	J	UG/KG	D41MSA0201	4 / 1 / 9	41.00 - 160.00	180.00	360	N/A	30000	890	C	N/A	BSL
151242	Benzol(g,h,i)perylene	120.00	J	280.00	J	UG/KG	D41MSA0201	3 / 1 / 9	41.00 - 140.00	158.67	280	N/A	9500000	230000	N/A	NO	BSL
727069	Benzol(k)fluoranthene	73.00	J	170.00	J	UG/KG	D41MSA0401	3 / 1 / 9	41.00 - 160.00	110.33	170	N/A	300000	8900	C	N/A	BSL
7440417	Beryllium (Be)	0.27	J	0.83	J	MG/KG	D41MSA0501	4 / 1 / 9	0.06 - 0.44	0.51	0.83	N/A	530	16	N/A	NO	BSL
85087	Bis(2-ethylhexyl)phthalate	38.00	J	700.00	J	UG/KG	D41MSA0201	3 / 1 / 9	400.00 - 1400.00	106.00	200	N/A	63000000	1600000	N/A	NO	BSL
66748	Calbazone	48.00	J	95.00	J	UG/KG	D41MSA0201	2 / 1 / 9	410.00 - 1400.00	72.00	95	N/A	1100000	32000	C	N/A	BSL
1089207	Chenanthrene	7.00	J	7.00	J	UG/KG	D41MSA0201	1 / 1 / 9	12.00 - 83.03	7.00	7	N/A	6000000	150000	N/A	NO	BSL
218019	Chrysene	180.00	J	510.00	J	UG/KG	D41MSA0701	3 / 1 / 9	41.00 - 140.00	340.00	510	N/A	3000000	89000	C	N/A	BSL
7442494	Cobalt (Co)	0.30	J	13.40	J	MG/KG	D41MSA0201	7 / 1 / 9	0.20 - 1.30	4.97	13.4	N/A	19000	470	N/A	NO	BSL
7440508	Copper (Cu)	13.10	J	317.00	J	MG/KG	D41MSA0401	8 / 1 / 9	3.10 - 3.10	110.15	317	N/A	13000	310	N/A	NO	BSL
94742	Dibn-butylphthalate	136.00	J	109.00	J	UG/KG	D41MSA0501	1 / 1 / 9	400.00 - 1400.00	100.00	100	N/A	32000000	780000	N/A	NO	BSL
117840	Dibn-octylphthalate	22.00	J	22.00	J	UG/KG	D41MSA0501	1 / 1 / 9	410.00 - 1600.00	22.00	22	N/A	6300000	160000	N/A	NO	BSL
95571	Dieldrin	0.42	J	7.10	J	UG/KG	D41MSA0201	4 / 1 / 9	0.20 - 0.81	2.72	7.1	N/A	1400	40	C	N/A	BSL
33212659	Endosulfan II	1.70	J	1.70	J	UG/KG	D41MSA0101	1 / 1 / 9	0.20 - 0.73	1.70	1.7	N/A	1500000	47000	N/A	NO	BSL
72208	Endrin	1.10	J	1.10	J	UG/KG	D41MSA0101	1 / 1 / 9	0.20 - 0.73	1.10	1.1	N/A	65000	2300	N/A	NO	BSL
7421234	Endrin aldehyde	0.72	J	0.72	DU	UG/KG	D41MSA0501	1 / 1 / 9	0.20 - 0.73	0.72	0.72	N/A	25000	2300	N/A	NO	BSL
53494705	Endrin ketone	0.26	J	0.26	J	UG/KG	D41MSA0501	1 / 1 / 9	0.21 - 0.81	0.26	0.26	N/A	95000	2300	N/A	NO	BSL
204440	Fluoranthene	71.00	J	1100.00	J	UG/KG	D41MSA0401	6 / 1 / 9	41.00 - 120.00	398.83	1100	N/A	1500000	310000	N/A	NO	BSL
193336	Indene(1,2,3-cd)pyrene	110.00	J	310.00	J	UG/KG	D41MSA0701	3 / 1 / 9	41.00 - 140.00	203.33	310	N/A	30000	890	C	N/A	BSL
7433978	Mandary (Hg)	0.25	J	1.00	J	MG/KG	D41MSA0201	6 / 1 / 9	0.08 - 0.17	0.41	1	N/A	55	2.3	N/A	NO	BSL
75092	Methylene chloride	250.00	J	250.00	J	UG/KG	D41MSA0101	1 / 1 / 9	12.00 - 83.03	250.00	250	N/A	2900000	85000	C	N/A	BSL
7440503	Nickel (Ni)	1.30	J	53.90	J	MG/KG	D41MSA0201	8 / 1 / 9	5.30 - 5.30	21.24	53.9	N/A	5500	150	N/A	NO	BSL
85018	Phenanthrene	110.00	J	240.00	J	UG/KG	D41MSA0701	3 / 1 / 9	41.00 - 140.00	132.33	240	N/A	9500000	230000	N/A	NO	BSL
120020	Pyrene	71.00	J	730.00	J	UG/KG	D41MSA0201	6 / 1 / 9	41.00 - 120.00	320.00	730	N/A	9500000	230000	N/A	NO	BSL
7782452	Selenium (Se)	1.50	J	3.40	J	MG/KG	D41MSA0101	6 / 1 / 9	0.18 - 0.22	2.13	3.4	N/A	1600	39	N/A	NO	BSL
7440224	Silver (Ag)	0.42	J	5.20	J	MG/KG	D41MSA0201	3 / 1 / 9	0.24 - 1.40	2.24	5.2	N/A	1500	39	N/A	NO	BSL
7440235	Sodium (Na)	8.60	J	122.00	J	MG/KG	D41MSA0401	8 / 1 / 9	2.60 - 2.60	60.26	122	N/A	N/A	N/A	N/A	NO	EN
7440280	Thallium (Tl)	1.40	J	1.40	J	MG/KG	D41MSA0501	1 / 1 / 9	0.19 - 1.30	1.40	1.4	N/A	22	5.5	N/A	NO	BSL
108983	Toluene	5.00	J	280.00	J	UG/KG	D41MSA0401	4 / 1 / 9	12.00 - 53.00	102.00	280	N/A	63000000	1600000	N/A	NO	BSL
7440922	Vanadium (V)	2.20	J	24.00	J	MG/KG	D41MSA0701	7 / 1 / 9	0.83 - 1.10	14.34	24	N/A	2200	55	N/A	NO	BSL
75014	Vinyl chloride	42.00	J	42.00	J	UG/KG	D41MSA0201	1 / 1 / 9	4.00 - 53.00	42.00	42	N/A	12000	3400	C	N/A	BSL
319446	alpha-BHC	0.30	J	1.60	J	UG/KG	D41MSA0501	4 / 1 / 9	0.16 - 0.45	0.77	1.6	N/A	3500	100	C	N/A	BSL
5103216	alpha-Chlordane	0.19	J	1.60	J	UG/KG	D41MSA0501	4 / 1 / 9	0.10 - 0.36	0.85	1.6	N/A	63000	1800	C	N/A	BSL
111811	bis(2-Chloroethoxy)methane	110.00	J	110.00	J	UG/KG	D41MSA0501	1 / 1 / 9	400.00 - 1400.00	110.00	110	N/A	N/A	N/A	N/A	NO	NTX
117817	bis(2-Ethylhexyl)phthalate (BEHF)	400.00	J	1500.00	J	UG/KG	D41MSA0701	3 / 1 / 9	410.00 - 1400.00	1163.33	1500	N/A	1600000	45000	C	N/A	BSL
5103742	gamma-Chlordane	0.23	J	1.30	J	UG/KG	D41MSA0301	3 / 1 / 9	0.10 - 0.35	0.84	1.3	N/A	82000	1900	C	N/A	BSL
7429205	Aluminum (Al)	491.00	J	18700.00	J	MG/KG	D41MSA0101	5 / 1 / 9	NAV	7536.57	18700	N/A	320000	7800	N/A	NO	BSL
7440393	Boron (B)	1.30	J	150.00	J	MG/KG	D41MSA0501	8 / 1 / 9	NAV	34.67	150	N/A	22000	560	N/A	NO	BSL
7440439	Cadmium (Cd)	0.27	J	220.00	J	MG/KG	D41MSA0701	5 / 1 / 9	NAV	29.10	220	N/A	320	7.8	N/A	NO	BSL
7440702	Calcium (Ca)	109.00	J	71000.00	J	MG/KG	D41MSA0201	9 / 1 / 9	NAV	11425.56	71000	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	2.80	J	416.00	J	MG/KG	D41MSA0501	5 / 1 / 9	NAV	87.25	416	N/A	1600	23	N/A	NO	BSL
7438996	Iron (Fe)	395.00	J	9930.00	J	MG/KG	D41MSA0501	3 / 1 / 9	NAV	4041.33	9930	N/A	N/A	N/A	N/A	NO	EN
7439221	Lead (Pb)	11.50	J	481.00	J	MG/KG	D41MSA0201	2 / 1 / 9	NAV	190.40	481	N/A	400	400	N/A	NO	ASL
7439254	Magnesium (Mg)	27.10	J	5500.00	J	MG/KG	D41MSA0701	2 / 1 / 9	NAV	1111.63	5500	N/A	N/A	N/A	N/A	NO	EN
7439855	Manganese (Mn)	1.40	J	205.00	J	MG/KG	D41MSA0701	9 / 1 / 9	NAV	51.32	205	N/A	15000	1100	N/A	NO	BSL
7440297	Potassium (K)	10.53	J	413.00	J	MG/KG	D41MSA0501	9 / 1 / 9	NAV	175.71	413	N/A	N/A	N/A	N/A	NO	EN
7440998	Zinc (Zn)	2.80	J	2290.00	J	MG/KG	D41MSA0701	9 / 1 / 9	NAV	487.19	2290	N/A	95000	2300	N/A	NO	BSL

- (1) Minimum/Maximum detected concentration.  
(2) Maximum concentration used as screening value.  
(3) No background concentrations were developed for this media.  
(4) PPRs for one trespasser scenario calculated based on Equations and parameters presented in Section 8 of this report.  
(5) RSCs for residential soil presented in Region III Risk-Based Concentration Tables, (USEPA 1988).  
(6) Rationale Codes:  
Selection Reason: Above Screening Levels (ASL)  
Detection Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
External Material (EN)

Definitions: N/A = Not Applicable  
NAV = Not Available  
COPC = Chemical of Potential Concern  
ARAR/BC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
J = Estimated Value  
C = Carcinogenic  
N = Noncarcinogenic

TABLE 10-2-18  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetlands 5A and 5B  
Surface Water

		(1)		(1)								(2)		(3)	(4)		(5)
CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection
75343	1,1-Dichloroethane	1.00		3.00		UG/L	041W5B0201	2 / 7	NAV	2.00	3	N/A	7300	80	N	N/A	BSL
95578	2-Chlorophenol	1.00	J	1.00	J	UG/L	041W5B0201	1 / 7	NAV	1.00	1	N/A	82	18	N	N/A	BSL
59507	4-Chloro-3-methylphenol	1.00	J	1.00	J	UG/L	041W5B0201	1 / 7	NAV	1.00	1	N/A	N/A	N/A	N	N/A	NTX
67641	Acetone	8.00	J	9.00	J	UG/L	041W5A0601	2 / 7	NAV	8.50	9	N/A	21000	370	N	N/A	BSL
7429905	Aluminum (Al)	153.00	J	2060.00		UG/L	041W5B0201	6 / 7	NAV	707.33	2060	N/A	120000	3700	N	N/A	BSL
7440360	Antimony (Sb)	3.10	J	3.10		UG/L	041W5A0501	1 / 7	NAV	3.10	3.1	N/A	48	1.5	N	N/A	BSL
7440393	Barium (Ba)	13.60	J	41.40		UG/L	041W5A0101	7 / 7	NAV	26.79	41.4	N/A	8300	260	N	N/A	BSL
75274	Bromodichloromethane	2.00		2.00		UG/L	041W5A0601	1 / 7	NAV	2.00	2	N/A	110	0.17	C	N/A	BSL
7440439	Cadmium (Cd)	3.20	J	19.00		UG/L	041W5B0201	2 / 7	NAV	11.10	19	N/A	60	1.8	N	N/A	BSL
7440702	Calcium (Ca)	5460.00		28600.00		UG/L	041W5A0501	7 / 7	NAV	15637.14	28600	N/A	N/A	N/A	N	N/A	EN
67663	Chloroform	1.00		1.00		UG/L	041W5A0601	1 / 7	NAV	1.00	1	N/A	730	0.15	C	N/A	BSL
7440473	Chromium (Cr)	11.40		40.80		UG/L	041W5B0201	2 / 7	NAV	26.10	40.8	N/A	360	1.1	N	N/A	BSL
7440484	Cobalt (Co)	3.00		3.90	J	UG/L	041W5B0201	2 / 7	NAV	3.45	3.9	N/A	7100	220	N	N/A	BSL
7440508	Copper (Cu)	7.20	J	52.70		UG/L	041W5B0201	4 / 7	NAV	25.20	52.7	N/A	4800	150	N	N/A	BSL
124481	Dibromochloromethane	2.00		2.00		UG/L	041W5A0601	1 / 7	NAV	2.00	2	N/A	200	0.13	C	N/A	BSL
959988	Endosulfan I	0.03	J	0.03		UG/L	041W5A0101	1 / 7	NAV	0.03	0.03	N/A	780	22	N	N/A	BSL
7439896	Iron (Fe)	357.00	J	2890.00		UG/L	041W5B0201	7 / 7	NAV	1368.14	2890	N/A	N/A	N/A	N	N/A	EN
7439921	Lead (Pb)	2.80	J	94.10		UG/L	041W5B0201	6 / 7	NAV	25.17	94.1	N/A	15	15	N	TTAL	YES
7439954	Magnesium (Mg)	2090.00	J	6710.00		UG/L	041W5A0501	7 / 7	NAV	3294.29	6710	N/A	N/A	N/A	N	N/A	EN
7439965	Manganese (Mn)	20.50		109.00		UG/L	041W5B0201	7 / 7	NAV	57.20	109	N/A	2400	73	N	N/A	BSL
7439976	Mercury (Hg)	0.14	J	0.14		UG/L	041W5B0201	1 / 7	NAV	0.14	0.14	N/A	36	1.1	N	N/A	BSL
621647	N-Nitroso-di-n-propylamine	1.00	J	1.00		UG/L	041W5B0201	1 / 7	NAV	1.00	1	N/A	1.1	0.0096	C	N/A	BSL
7440097	Potassium (K)	1050.00	J	5580.00		UG/L	041W5A0501	7 / 7	NAV	2592.86	5580	N/A	N/A	N/A	N	N/A	EN
129000	Pyrene	2.00		2.00		UG/L	041W5B0201	1 / 7	NAV	2.00	2	N/A	54	110	N	N/A	BSL
7440235	Sodium (Na)	7710.00		21300.00		UG/L	041W5A0501	7 / 7	NAV	12290.00	21300	N/A	N/A	N/A	N	N/A	EN
7440280	Thallium (Tl)	3.50	J	3.50		UG/L	041W5A0101	1 / 7	NAV	3.50	3.50	N/A	8.3	0.26	N	N/A	BSL
79016	Trichloroethene	10.00		10.00		UG/L	041W5B0201	1 / 7	NAV	10.00	10	N/A	280	1.6	C	N/A	BSL
7440622	Vanadium (V)	4.80	J	5.20	J	UG/L	041W5B0201	2 / 7	NAV	5.00	5.2	N/A	830	26	N	N/A	BSL
75014	Vinyl chloride	6.00		6.00		UG/L	041W5B0201	1 / 7	NAV	6.00	6	N/A	3.1	0.019	C	N/A	YES
7440666	Zinc (Zn)	55.80		236.00		UG/L	041W5A0601	5 / 7	NAV	136.44	236	N/A	36000	1100	N	N/A	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	2.00	J	5.00		UG/L	041W5A0401	5 / 7	NAV	2.80	5	N/A	110	4.8	C	N/A	BSL
156592	cis-1,2-Dichloroethene	1.00		1.00		UG/L	041W5A0601	1 / 7	NAV	1.00	1	N/A	670	6.1	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap Water RBCs are presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Detection Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TTAL = Treatment Technique Action Level

TABLE 10-2-19  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface water  
Exposure Medium: Surface water  
Exposure Point: Wetlands 5A and 5B  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Vinyl chloride	0.006	MG/L	N/A	M	3.53E-07	mg/kg-day	1.9	(mg/kg-day) <sup>-1</sup>	6.71E-07
Dermal	Vinyl chloride	0.006	MG/L	N/A	M	5.36E-07	mg/kg-day	2.375	(mg/kg-day) <sup>-1</sup>	1.27E-06
<b>Total Risk</b>										<b>1.94E-06</b>

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

This additional exposure was presented as an “alternate” source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were retained to simulate background exposures, in order to provide a conservative estimate of daily intake from sources unrelated to Wetland 5.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water and 100 mg of sediment during every visit, represented in the Lead Model as an alternate source. The bioavailability of lead ingested from the alternate source (Wetland 5 sediment and surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water and 100 milligrams of sediment once per week with a lead concentrations of 94.1  $\mu\text{g/L}$  (surface water) and 481 mg/kg (soil), the annual alternate source exposure was estimated to be 7.52  $\mu\text{g}$  lead/day. Table 10-2-19 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-2-4 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 3.3  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.82%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, sediment and surface water lead concentrations at Wetland 5A would not require specific action under the hypothetical exposure scenario.

#### 10.2.5.7 Remedial Goal Options

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Vinyl chloride was the only COC identified at this wetland. Because vinyl chloride was identified as a COC for surface water based only on cancer risk estimates, only risk based RGOs were developed. The maximum vinyl chloride concentration of 0.006 mg/L in surface water resulted in a risk estimate of 1.94E-6, as shown in Table 10-2-20. Using a linear ratio, 0.0031 mg/L would correspond with a target risk of 1E-6. Therefore, 0.031 mg/L and 0.31 mg/L represent target risks of 1E-5 and 1E-4, respectively.

*Final Remedial Investigation Report*  
*NAS Pensacola Site 4I*  
*Section 10: Site-Specific Evaluations*  
*August 31, 2000*

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**Table 10-2-20**  
**Lead Model (Version 0.99d) Inputs and Results**  
**NAS Pensacola, Wetland 5**  
**Pensacola, Florida**

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 5A sediment and surface water

6-7: 7.52  $\mu\text{g Pb}/\text{day}$

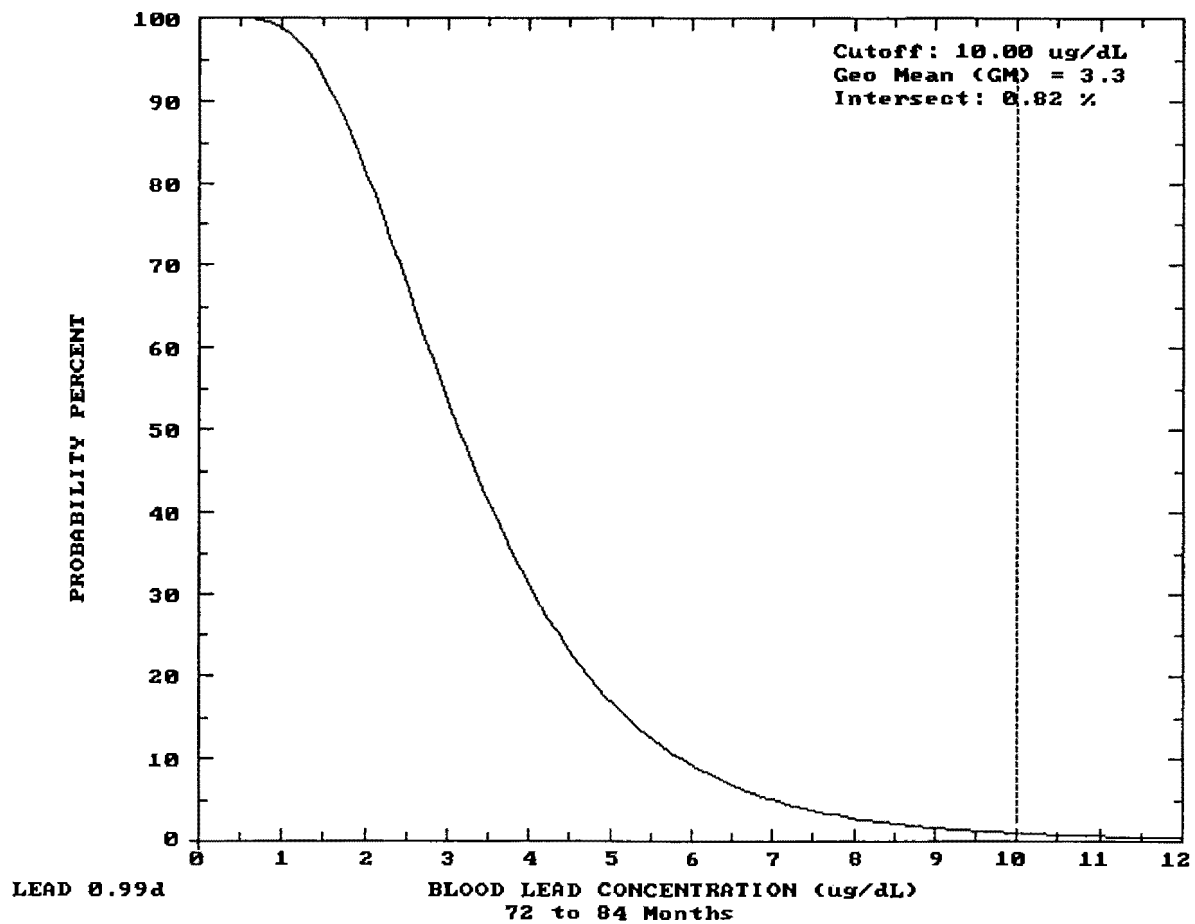
MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil + Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	3.3	12.88	4.82	3.31	1.11	3.55	0.09

Figure 10-2-4 Probability Plots for Blood Lead Levels Wetland 5





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#### **10.2.6 Conclusions and Recommendations**

Wetland 5A was sampled as a Group B wetland during Phase IIB/III. Wetland 5B was classified with Group D. The Group D wetlands appear as man-made drainage ditches and are in developed areas of the base. Due to their channelized features and proximity to developed areas, they have limited ecological receptors. As proposed in the approved RI/FS SAP Addendum, (EnSafe, 1997), Wetland 5B was eliminated for further ecological risk characterization.

Phase IIB/III assessment endpoint and triad analyses revealed that sediment and surface water were acceptable at Wetland 5A.

The HHRA identified lead as a sediment COPC, and lead and vinyl chloride as surface water COPCs at Wetlands 5A and 5B. No fish tissue COPCs were identified for these wetlands. Only vinyl chloride in surface water was considered under the adolescent trespasser scenario, based on its contribution to cumulative risk estimates for this wetland. Under USEPA guidelines, sediment and surface water lead concentrations at Wetland 5A would not require specific action under the hypothetical exposure scenario. Since Wetlands 5A and 5B have no recreational value for swimming, the potential for incidental ingestion of surface water is considered low. Also, these wetlands have generally restricted public access. Because of the limited overall ecological risk at Wetlands 5A and 5B, the restricted access to human trespassing within these areas, and the limited potential for surface water ingestion by adolescent trespassers, no further action is recommended for Wetlands 5A and 5B.

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## **10.3 Wetland 3**

### **10.3.1 Site Description**

Wetland 3 lies west of the A.C. Read golf course, on the northeastern edge of Site 1. Wetland 3 drains via a culvert running under John Tower Road, and beneath a golf course fairway into Wetland 4D.

Parsons and Pruitt (USEPA, 1991) described this area as a palustrine system with predominantly scrub-shrub emergent vegetation. The area contains sweet bay magnolias (*Magnolia virginiana*), cattails (*Typha latifolia*), and sawgrass (*Cladium jamaicense*). A shallow sheet flow of water drains from the southwest to the northeast across this wetland, before discharging into Wetland 4D. Groundwater seepage and surface water drainage occurs in this area, and the presence of iron is visibly apparent. Surface water at this wetland ranges from 0.25 to about 1 foot in depth. Sediment is highly organic, with TOC detected up to 24%.

The IR site potentially affecting Wetland 3 is Site 1 (Sanitary Landfill), used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base (NEESA, 1983). The Site 1 RI report (E/A&H, 1996) determined that the groundwater sample collected from the monitoring well closest to Wetland 3 exceeded surface water criteria. Based on this exceedance, a groundwater interception trench is currently being installed upgradient of the wetland to prevent the shallow groundwater from discharging to the wetland. The recovered groundwater will be discharged to the sewer line for treatment at the wastewater treatment plant.

### **10.3.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-3-1 denotes the Phase IIA Wetland 3 sampling locations.

## **Sediment**

Nineteen metals plus cyanide were detected in Wetland 3 sediment samples. Six metals — arsenic (12.8 ppm, 35.5 ppm, and 27.1 ppm at locations 0302, 0303, and 0307), cadmium (2.2 ppm, 5.8 ppm, 2.9 ppm, 2.0 ppm, 1.8 ppm, and 72.7 ppm at locations 0101, 0302, 0303, 0305, 0306, and 0307), chromium (196 ppm at location 0307), copper (68.8 ppm at location 0307), lead (36.3 ppm and 101 ppm at locations 0101 and 0302), and zinc (297 ppm at location 0307) — exceeded sediment benchmark levels at Wetland 3. Thirteen pesticides were detected in Wetland 3 sediment samples: 4,4'-DDT and its metabolites, aldrin, alpha/beta/delta-BHC, dieldrin, endosulfan sulfate, endrin/endrin ketone, and alpha/gamma-chlordane. 4,4'-DDD (400 ppb), 4,4'-DDE (120 ppb), and 4,4'-DDT (220 ppb) exceeded basewide levels at sample location 0103. All other concentrations of 4,4'-DDT and its metabolites were below basewide levels.

Alpha-chlordane exceeded its sediment benchmark level (1.7 ppb) at location 0103 (2.2 ppb). Dieldrin exceeded its benchmark level (0.72) ppb at location 0302 (6.0 ppb). The PCB Aroclor-1260 at location 0302 (350 ppb) also exceeded its sediment screening level (21.6 ppb). Twenty-one SVOCs were detected in Wetland 3 sediment samples, many of which were high- and low-molecular weight PAHs. Other SVOCs detected included four different phthalate esters, as well as 1,2- and 1,4-dichlorobenzene. Four PAHs exceeded sediment benchmark levels, including acenaphthene (98 ppb) at location 0303, benzo(a)pyrene (180 ppb) at location 0307, and fluorene (95 ppb) and naphthalene (160 ppb) at location 0303. The phthalate ester bis(2-ethylhexyl)phthalate also exceeded its benchmark level at locations 0305 (210 ppb) and 0307 (270 ppb), respectively. Five VOCs were detected at Wetland 3 including 2-butanone, acetone, benzene, chlorobenzene, and toluene. Acetone is a common laboratory contaminant.

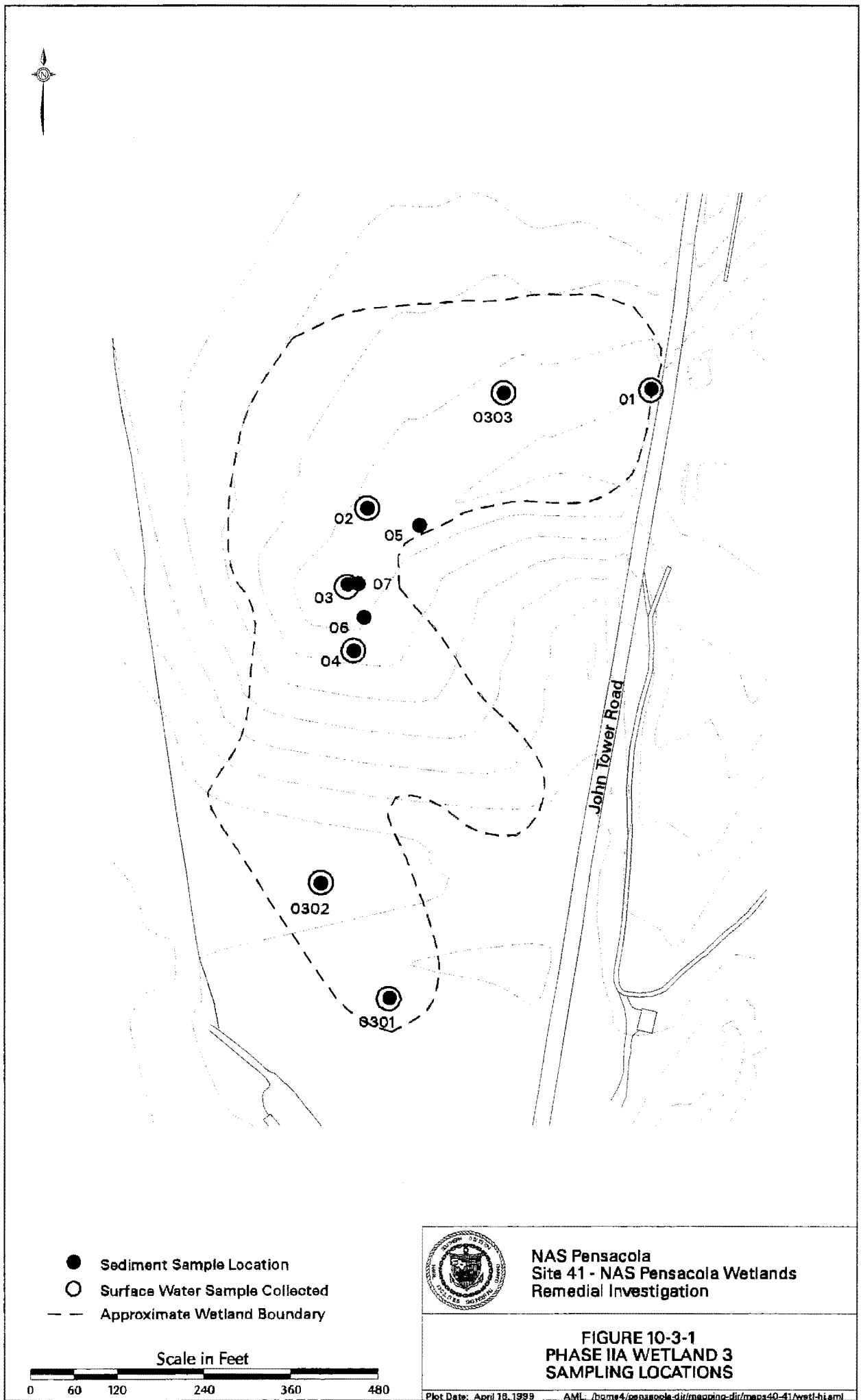


Table 10-3-1 shows the Wetland 3 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-3-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-3-2. The HQs will be discussed further in the ecological risk section.

**Table 10-3-1**  
**Phase IIA Detected Concentrations in Wetland 3 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	10/10	426 - 25600	4517.9
Antimony (Sb)	3/10	0.23 - 2.4	1.02
Arsenic (As)	9/10	0.56 - 35.5	9.63
Barium (Ba)	10/10	1.6 - 438	53.19
Cadmium (Cd)	7/10	0.52 - 72.7	12.56
Calcium (Ca)	10/10	350 - 31800	7325.99
Chromium (Cr)	10/10	1.5 - 196	26.13
Cobalt (Co)	1/10	2.5	2.5
Copper (Cu)	5/10	2.2 - 68.8	19.91
Cyanide (CN)	2/10	1.5 - 5.1	3.3
Iron (Fe)	10/10	1940 - 386000	60030
Lead (Pb)	10/10	2.4 - 101	20.61
Magnesium (Mg)	9/10	23.2 - 1420	272.79
Manganese (Mn)	10/10	2.3 - 1270	152.08
Nickel (Ni)	1/10	0.78	0.78
Potassium (K)	7/10	10.9 - 468	97.24
Selenium (Se)	3/10	0.44 - 2	1.41
Sodium (Na)	6/10	4.5 - 291	102.2
Vanadium (V)	10/10	1.2 - 160	21.24
Zinc (Zn)	10/10	1.2 - 297	37.42
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	10/9	1.3 - 400	49.11
4,4'-DDE	7/9	0.84 - 120	21.59
4,4'-DDT	9/9	0.32 - 220	27.08
Aldrin	3/9	0.23 - 1	0.64
alpha-Chlordane	8/9	0.17 - 2.2	0.76
alpha-BHC	3/9	0.19 - 1.2	0.61
Aroclor-1260	1/10	350	350
beta-BHC	1/9	0.7	0.7
delta-BHC	2/9	0.18 - 0.25	0.22
Dieldrin	1/9	6	6

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-3-1  
 Phase IIA Detected Concentrations in Wetland 3 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Pesticides and PCBs (<math>\mu\text{g/kg}</math>)</b>			
Endosulfan sulfate	2/9	1.5 - 1.7	1.6
Endrin	4/9	0.53 - 1.8	1.16
Endrin ketone	1/10	1.4	1.4
gamma-Chlordane	3/9	0.11 - 1.7	0.78
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
1,2-Dichlorobenzene	1/10	410	410
1,4-Dichlorobenzene	4/10	58 - 1400	754.5
Acenaphthene	1/10	98	98
<b>SVOCs (<math>\mu\text{g/kg}</math>) continued</b>			
Benzo(a)anthracene	1/10	23	23
Benzo(a)pyrene	2/10	48 - 180	114
Benzo(b)fluoranthene	1/10	85	85
Benzo(g,h,i)perylene	1/10	46	46
Benzo(k)fluoranthene	1/10	27	27
Butylbenzylphthalate	1/10	23	23
Chrysene	1/10	32	32
Di-n-butylphthalate	2/10	36 - 77	56.5
Di-n-octyl phthalate	2/10	45 - 45	45
Diethylphthalate	1/10	47	47
Fluoranthene	1/10	46	46
Fluorene	1/10	95	95
Indeno(1,2,3-cd)pyrene	1/10	31	31
Naphthalene	1/10	160	160
Phenanthrene	1/10	24	24
Phenol	1/10	55	55
Pyrene	1/10	43	43
bis(2-Ethylhexyl)phthalate (BEHP)	4/10	76 - 270	161
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Butanone (MEK)	1/7	180	180
Acetone	1/8	1100	1100
Benzene	2/10	18-34	26
Chlorobenzene	6/10	2-620	182.33
Toluene	1/10	2	2

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).



**Table 10-3-2 (1)**  
**Wetland 3**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>001M000302</b>					
	4,4'-DDD (UG/KG)	6.2	1.22	5.08	b
	4,4'-DDE (UG/KG)	2.5 J	2.07	1.21	b
	4,4'-DDT (UG/KG)	1.3 J	1.19	1.09	b
	alpha-Chlordane (UG/KG)	0.51 J	1.7	0.30	a
	Arsenic (MG/KG)	1.6 J	7.24	0.22	a b
	Chromium (MG/KG)	24	52.3	0.05	a b
	Lead (MG/KG)	6.5 J	30.2	0.18	a b
	Zinc (MG/KG)	6	124	0.06	a b
<b>001M000303</b>					
	4,4'-DDD (UG/KG)	104 J	1.22	102.8	b
	4,4'-DDE (UG/KG)	108 J	2.07	105.9	b
	4,4'-DDT (UG/KG)	100	1.19	100.0	b
	alpha-Chlordane (UG/KG)	1.0 J	1.7	1.28	a
	Chromium (MG/KG)	18	52.3	0.05	a b
	Lead (MG/KG)	1.0 J	30.2	0.03	a b
	Zinc (MG/KG)	4	124	0.03	a b
<b>041M030101</b>					
	4,4'-DDD (UG/KG)	14 DJ	1.22	11.48	b
	4,4'-DDE (UG/KG)	21 DJ	2.07	10.14	b
	4,4'-DDT (UG/KG)	7.5 DJ	1.19	6.30	b
	alpha-Chlordane (UG/KG)	0.88 J	1.7	0.40	a
	Arsenic (MG/KG)	1.8	7.24	0.25	a b
	Benzo(a)anthracene (UG/KG)	23 J	74.8	0.31	b
	Benzo(a)pyrene (UG/KG)	48	88.8	0.54	b
	Cadmium (MG/KG)	0.52 J	0.68	0.76	b
	Chromium (MG/KG)	4.5	52.3	0.09	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SVVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

**Table 10-3-2 (2)**  
**Wetland 3**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV : HQ Reference
	Chrysene (UG/KG)	32 J	108	0.30	b
	Copper (MG/KG)	2.2 J	10.7	0.12	a b
	Endrin (UG/KG)	0.98 J	3.3	0.30	a
	Fluoranthene (UG/KG)	46	113	0.41	b
	Lead (MG/KG)	128 J	302	0.42	a b
	Phenanthrene (UG/KG)	24 J	80.7	0.29	b
	Pyrene (UG/KG)	43	193	0.28	b
	Zinc (MG/KG)	6.4 J	124	0.05	a b

041M030301				
4,4'-DDT (UG/KG)	1.4 J	11.22	0.07	0
4,4'-DDE (UG/KG)	0.84 J	2.07	0.41	b
4,4'-DDT (UG/KG)	0.48 J	1.19	0.40	b
Acenaphthene (UG/KG)	94	6.71	14.61	b
Antimony (MG/KG)	0.44 J	12	0.04	a
Arsenic (MG/KG)	35.9	7.24	4.90	a b
Cadmium (MG/KG)	2.9	0.68	4.26	b
Chromium (MG/KG)	7.3	62.3	0.14	a b
Copper (MG/KG)	4.6	18.7	0.25	a b
Endrin (UG/KG)	1.8 J	3.3	0.55	a
Fluorene (UG/KG)	95	21.2	4.48	b
Lead (MG/KG)	11.5	30.2	0.38	a b
Naphthalene (UG/KG)	160	34.6	4.62	b
Zinc (MG/KG)	3.3	124	0.03	a b

041M030301				
4,4'-DDD (UG/KG)	1.4 J	11.22	0.07	0
4,4'-DDE (UG/KG)	0.84 J	2.07	0.41	b
4,4'-DDT (UG/KG)	0.48 J	1.19	0.40	b
Acenaphthene (UG/KG)	94	6.71	14.61	b
Antimony (MG/KG)	0.44 J	12	0.04	a
Arsenic (MG/KG)	35.9	7.24	4.90	a,b
Cadmium (MG/KG)	2.9	0.88	4.26	b
Chromium (MG/KG)	7.3	62.3	0.14	a,b
Copper (MG/KG)	4.6	18.7	0.25	a,b
Endrin (UG/KG)	1.8 J	0.3	0.55	a
Fluorene (UG/KG)	95	21.2	4.48	b
Lead (MG/KG)	11.5	30.2	0.38	a,b
Naphthalene (UG/KG)	160	34.9	4.62	b
Zinc (MG/KG)	3.4	124	0.03	a,b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SVVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

Table 10-3-2 (3)  
Wetland 3  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
041M030501	4,4'-DDD (UG/KG)	3.5 J	1.22	2.87	b
041M030501	Antimony (MG/KG)	0.23 J	12	0.02	a
041M030501	Arsenic (MG/KG)	3.5	7.24	0.48	a b
041M030501	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	210 J	182	1.15	b
041M030501	Cadmium (MG/KG)	2	0.68	2.94	b
041M030501	Chromium (MG/KG)	5.3	52.3	0.10	a b
041M030501	Endrin (UG/KG)	1.3 J	3.3	0.38	a
041M030501	Endrin ketone (UG/KG)	1.4 J	3.3	0.42	a
041M030501	Lead (MG/KG)	2.4	30.2	0.08	a b
041M030501	Zinc (MG/KG)	1.2	124	0.01	a b

**041M030501**

4,4'-DDD (UG/KG)	3.5 J	1.22	2.87	b
Antimony (MG/KG)	0.23 J	12	0.02	a
Arsenic (MG/KG)	3.5	7.24	0.48	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	210 J	182	1.15	b
Cadmium (MG/KG)	2	0.68	2.94	b
Chromium (MG/KG)	5.3	52.3	0.10	a b
Endrin (UG/KG)	1.3 J	3.3	0.38	a
Endrin ketone (UG/KG)	1.4 J	3.3	0.42	a
Lead (MG/KG)	2.4	30.2	0.08	a b
Zinc (MG/KG)	1.2	124	0.01	a b

**041M030601**

4,4'-DDD (UG/KG)	7.7 D	1.22	6.31	b
4,4'-DDE (UG/KG)	2.5 J	2.07	1.21	b
4,4'-DDT (UG/KG)	1.9 J	1.19	1.60	b
alpha-Chlordane (UG/KG)	0.69 J	1.7	0.41	a
Arsenic (MG/KG)	2.2	7.24	0.30	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	88 J	182	0.48	b
Cadmium (MG/KG)	1.8	0.68	2.65	b
Chromium (MG/KG)	4.9	52.3	0.09	a b
gamma-Chlordane (UG/KG)	0.54	1.7	0.32	a
Lead (MG/KG)	8	30.2	0.26	a b
Zinc (MG/KG)	6.3	124	0.05	a b

**041M030701**

4,4'-DDD (UG/KG)	6.8 J	1.22	5.57	b
4,4'-DDT (UG/KG)	0.94 J	1.19	0.79	b
alpha-Chlordane (UG/KG)	0.45 J	1.7	0.26	a
Arsenic (MG/KG)	27.1	7.24	3.74	a b
Benzo(a)pyrene (UG/KG)	180	88.8	2.03	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	270 J	182	1.48	b
Cadmium (MG/KG)	72.7	0.68	106.91	b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SWs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding

Table 10-3-2 (4)

**Wetland 3****Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Chromium (MG/KG)	196	52.3	3.75	a b
	Copper (MG/KG)	68.8	18.7	3.68	a b
	Lead (MG/KG)	18.7	30.2	0.62	a b
	Zinc (MG/KG)	297	124	2.40	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SVVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

## **Surface Water**

Surface water samples were collected at locations 0101, 0102, 0103, 0301, 0302, 0303, and 0304. Sixteen metals were detected in Wetland 3 surface water samples. The surface water quality criteria for aluminum (87 ppb) and iron (1,000 ppb) were exceeded at all seven sample locations (170 ppb and 8,080 ppb at location 0101, 175 ppb and 8,430 ppb at location 0102, 98.6 ppb and 7,810 ppb at location 0103, 149 ppb and 17,900 ppb at location 0301, 2,150 ppb and 59,600 ppb at location 0302, 951 ppb and 176,000 ppb at location 0303, and 211 ppb and 21,500 ppb at location 0304). Cadmium (3.4 ppb) and lead (20.3 ppb) exceeded criteria at sample location 0302, while at sample location 0303, cadmium (3.8 ppb), copper (9.6 ppb), and lead (7.1 ppb) exceeded criteria. Lead (1.9 ppb) was also exceeded at sample location 0103. Endrin ketone, was detected at location 0302 at a concentration (0.25 ppb) above its surface water criteria (0.0023 ppb). Aroclor-1260 (0.5 ppb) was also detected at location 0302 above its criteria (0.014 ppb). Three SVOCs, naphthalene, and 1,2- and 1,4-dichlorobenzene were detected in Wetland 3 surface water below their respective water quality criteria. Four VOCs were detected in Wetland 3 surface water, including benzene, chlorobenzene, methylene chloride, and cis-1,2-dichloroethene. No VOCs exceeded any surface water quality standard. Methylene chloride is a common laboratory contaminant.

Table 10-3-3 shows the Wetland 3 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-3-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-3-4. The HQs will be further discussed ecological risk section.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-3-3  
 Phase IIA Detected Concentrations in Wetland 3 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	7/7	98.6 - 2150	557.8
Antimony (Sb)	2/7	3 - 3.3	3.15
Arsenic (As)	4/7	2.7 - 48.9	18
Barium (Ba)	7/7	27.6 - 56.8	37.61
Cadmium (Cd)	2/7	3.4 - 3.8	3.6
Calcium (Ca)	7/7	22900 - 32600	27800
Chromium (Cr)	2/7	8.7 - 9.3	9
Copper (Cu)	2/7	4.7 - 9.6	7.15
Iron (Fe)	7/7	7810 - 176000	42760
Lead (Pb)	3/7	1.9 - 20.3	9.77
Magnesium (Mg)	7/7	1540 - 2320	2170
Manganese (Mn)	7/7	127 - 265	167.43
Potassium (K)	7/7	1380 - 1950	1625.71
Sodium (Na)	7/7	5770 - 7420	6522.86
Vanadium (V)	4/7	2.2 - 11.1	6.125
Zinc (Zn)	1/7	10.4	10.4
<b>Pesticides and PCBs (<math>\mu\text{g/L}</math>)</b>			
Aroclor-1260	1/7	0.5	0.5
Endrin ketone	1/7	0.25	0.25
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
Naphthalene	1/7	1	1
1,2-Dichlorobenzene	1/7	1	1
1,4-Dichlorobenzene	6/7	2 - 10	4
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Benzene	5/7	1 - 3	1.8
Chlorobenzene	6/7	3 - 30	12.17
Methylene chloride	2/7	120	660
cis-1,2-Dichloroethene	1/7	1	1

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-3-4 (1)

## Wetland 3

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>001W000101 Freshwater</b>						
1,4-Dichlorobenzene		UG/L	2.0	11.2	0.17857	a
Aluminum		UG/L	175.0	87.0	2.01149	a
Benzene		UG/L	1.0	53.0	0.01887	a
Iron		UG/L	8,430.0	1,000.0	8.43	a b
<b>001W000302 Freshwater</b>						
1,4-Dichlorobenzene		UG/L	2.0	11.2	0.17857	a
Aluminum		UG/L	175.0	87.0	2.01149	a
Benzene		UG/L	1.0	53.0	0.01887	a
Iron		UG/L	8,430.0	1,000.0	8.43	a b
<b>001W000303 Freshwater</b>						
Aluminum		UG/L	98.8	87.0	1.13333	a
Iron		UG/L	7,810.0	1,000.0	7.81	a b
Lead		UG/L	1.9	1.71	1.11111	a b
<b>041W030101 Freshwater</b>						
1,4-Dichlorobenzene		UG/L	2.0	11.2	0.17857	a
Aluminum		UG/L	149.0	87.0	1.71264	a
Arsenic		UG/L	2.7	50.0	0.054	b
Iron		UG/L	17,900.0	1,000.0	17.9	a b
<b>041W030201 Freshwater</b>						
1,4-Dichlorobenzene		UG/L	4.0	11.2	0.35714	a
Aluminum		UG/L	2,150.0	87.0	24.71264	a
Antimony		UG/L	3.3	160.0	0.02062	a
Aroclor-1260		UG/L	0.5	0.014	35.71428	a b
Arsenic		UG/L	17.2	50.0	0.344	b
Benzene		UG/L	1.0	53.0	0.01887	a
Cadmium		UG/L	3.4	0.774	4.39276	a b
Chromium		UG/L	8.7	11.0	0.79091	a b
Copper		UG/L	4.7	7.8	0.60256	a b
Endrin ketone		UG/L	0.25	0.0023	108.69565	a b
Iron		UG/L	59,600.0	1,000.0	59.6	a b
Lead		UG/L	20.3	1.71	11.87134	a b
Zinc		UG/L	10.4	70.2	0.14815	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-3-4 (2)

**Wetland 3****Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W030301      Freshwater</b>						
	1,2-Dichlorobenzene	UG/L	1.0	15.8	0.06329	a
	1,4-Dichlorobenzene	UG/L	10.0	11.2	0.89286	a
	Aluminum	UG/L	951.0	87.0	10.93103	a
	Arsenic	UG/L	48.9	50.0	0.978	b
	Benzene	UG/L	2.0	53.0	0.03774	a
	Cadmium	UG/L	3.8	0.774	4.90956	a b
	Chromium	UG/L	9.3	11.0	0.84545	a b
	Copper	UG/L	9.6	7.8	1.23077	a b
	Iron	UG/L	176,000.0	1,000.0	176.0	a b
	Lead	UG/L	7.1	1.71	4.15205	a b
<b>041W030401      Freshwater</b>						
	1,4-Dichlorobenzene	UG/L	4.0	11.2	0.35714	a
	Aluminum	UG/L	211.0	87.0	2.42529	a
	Antimony	UG/L	3.0	160.0	0.01875	a
	Arsenic	UG/L	3.2	50.0	0.064	b
	Benzene	UG/L	3.0	53.0	0.0566	a
	Iron	UG/L	21,500.0	1,000.0	21.5	a b
	Naphthalene	UG/L	1.0	62.0	0.01613	a

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.



### 10.3.3 Fate and Transport

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data are lacking, the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-3-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-3-4.

#### Transport Into the Wetland

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 3 through this pathway:

- Potential storm water runoff and sediment entrainment from Site 1.

Sediment contaminants above benchmark levels (see Table 10-3-5) validate this sediment transport pathway, and by inference surface water as well. Additionally, four inorganics and one organic were present in surface water above criteria, further validating the pathway.

##### *Groundwater Discharge Pathway*

Based on potentiometric analysis, Site 1 is the primary potential source that would directly contribute contamination to Wetland 3 through this pathway. Contamination found in groundwater validates this pathway.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-3-5  
 Calculated Sediment Screening Values for Wetland 3

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Arsenic	50 <sup>b</sup>	2.9E+01	146	35.5	NO
Cadmium	0.774 <sup>a, b</sup>	7.5E+01	5.82	72.7	YES
Chromium	11 <sup>a, b</sup>	1.9E+01	21.1	196	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	336	68.8	NO
Lead	1.71 <sup>a, b</sup>	9E+02	154	101	NO
Zinc	70.2 <sup>a, b</sup>	6.2E+01	436	297	NO
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	10.5 <sup>a</sup>	2.55E+05	2.68E+08	120	NO
4,4 DDD	0.0064 <sup>a</sup>	5.7E+04	3.65E+04	400	NO
4,4 DDT	0.001 <sup>a, b</sup>	1.50E+05	1.50E+04	220	NO
Dieldrin	0.0019 <sup>a, b</sup>	1.22E+03	2.32E+02	6	NO
Acenaphthene	17 <sup>a</sup>	4.45E+02	7.57E+05	98	NO
Benzo(a)pyrene	0.031 <sup>b</sup>	5.83E+04	1.81E+05	180	NO
Fluoranthene	39.8 <sup>a</sup>	6.12E+03	2.44E+07	46	NO
Naphthalene	62 <sup>a</sup>	1.14E+02	7.07E+05	160	NO
Bis(2-ethylhexyl)phthalate	0.3 <sup>a</sup>	8.62E+05	2.59E+07	270	NO

Notes:

Kd for organics calculated using foc of 0.057 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix(USEPA,1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## **Transport Within The Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment transport will occur to the north towards a culvert draining into Wetland 4, and from there into Bayou Grande. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

### *Sediment Leaching to Surface Water Pathway*

Nine organics — four pesticides and five semivolatiles — and six inorganics exceeded their SSV (see Table 10-3-5), but only two — cadmium and chromium — exceeded their calculated SSLs (see Table 10-3-5). Cadmium was also present in the corresponding surface water above standards, indicating a high potential for this pathway. In surface water, parameters above standards included PCBs, copper, iron, and lead. These additional parameters are attributable to the surface water/groundwater discharge pathway from Site 1. Because cadmium was detected in sediment above its SSL and in surface water above standards and chromium exceeded its SSL, the pathway is considered valid, with a high potential for partitioning to surface water.

## **Transport From the Wetland**

Surface water and sediment from Wetland 3 can be expected to move into the drainage culvert connecting it with Wetland 4, and from there to Bayou Grande. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

### **10.3.4 Ecological Risk Assessment**

#### **10.3.4.1 Phase IIA**

HQs for Wetland 3 sediment samples are presented in Table 10-3-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic (1.77, 4.9, and 3.74 at locations 0302, 0303, and 0307), cadmium (3.24, 8.53, 4.26, 2.94, 2.65,

and 106.91 at locations 0101, 0302, 0303, 0305, 0306, and 0307), chromium (3.75 at location 0307), copper (3.68 at location 0307), lead (1.20 and 3.34 at locations 0101 and 0302), and zinc (2.40 at location 0307). 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT each had HQs above 1 at locations 0101 (15.57, 1.64, and 8.32), 0102 (5.08, 1.21, and 1.09), 0103 (327.87, 57.97, and 184.87), 0301 (11.48, 10.14, and 6.30), and 0306 (6.31, 1.21, and 1.60). 4,4'-DDD, and 4,4'-DDT also had HQs above 1 (25.41 and 1.18) at location 0302, while single concentrations of 4,4'-DDD had HQs above 1 at sample locations 0303 (1.07), 0304 (1.31), 0305 (2.87), and 0307 (5.57). As discussed in the nature and extent section, most concentrations of 4,4'-DDT and its metabolites were below basewide levels. Alpha-chlordane had a HQ above 1 at location 0103 (1.29). Dieldrin had a HQ greater than 1 at location 0302 (8.33), as did Aroclor-1260 (16.2). Four PAHs had HQs greater than 1 including acenaphthene (14.61) at location 0303, benzo(a)pyrene (2.03) at location 0307, and fluorene (4.48) and naphthalene (4.62) at location 0303. The phthalate ester bis(2-ethylhexyl)phthalate also had HQs above 1 at locations 0305 (1.15) and 0307 (1.48), respectively. Phase IIA surface water results revealed a HQ greater than 1 for aluminum and iron at all seven sample locations (1.95 and 8.08 at location 0101, 2.01 and 8.43 at location 0102, 1.13 and 7.81 at location 0103, 1.71 and 17.9 at location 0301, 24.71 and 59.6 at location 0302, 10.93 and 176 at location 0303, and 2.43 and 21.5 at location 0304). HQs were above 1 for cadmium (4.39) and lead (11.87) at sample location 0302, and also at sample location 0303 for cadmium (4.91), copper (1.23), and lead (4.15). Lead also had a HQ above 1 (1.11) at sample location 0103. The HQ was above 1 for endrin ketone (108.70) and Aroclor-1260 (35.71) at location 0302. HQs greater than 1 indicate the potential for excess risk.

Phase IIA surface water results revealed HIs from 10.05 to 247.27 at location 0302.

### **Phase IIB/III**

Based on the Phase IIA data, Wetland 3 was classified in Group B and sampled in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

### **Conceptual Model**

Freshwater Wetland 3, surrounded mostly by woods and downgradient of Site 1, is fed by several groundwater seeps in its southeastern portion. These seeps merge to form a narrow surface water channel through the wetland's center. The channel is about 4 inches deep and about one to two feet wide. The remaining portion of the wetland is mostly saturated sediment with a thin layer of surface water overlaying it. The degree of saturation varies depending on the amount of recent precipitation. An approximate 100 square foot and three foot deep area in the lower section of the wetland has been excavated to clear the drainage culvert into Wetland 4D. Small fish species have been observed in this excavated area. However, this wetland is not considered large enough to support higher trophic level fish species, and none have been observed. Contaminants of concern in this wetland are mostly metals and pesticides. This wetland supports small fish and benthic macroinvertebrates, which have been identified as the primary habitat functional uses. As with Wetland 5A, the conceptual model focuses on the toxic effects that may be occurring to fish and benthic macroinvertebrates since food chain impacts are not considered to be a viable exposure route. The conceptual model for Wetland 3 is shown on Figure 10-3-2.

### **Sampling Location Rationale**

Sediment samples for toxicity analysis, sediment chemistry, TOC, and grain size were collected from Phase IIA locations 2 and 7 (Figure 10-3-3). Three composite grab samples for benthic diversity were collected within 10 feet of each sample location to account for spatial variability. One surface water sample was collected from the newly excavated culvert for chemical analysis and fathead minnow (*Pimephales promelas*) toxicity analysis. This culvert, near sample location 1, is in the most downgradient portion of Wetland 3.

## **Ecological Risk Evaluation**

Risk in Wetland 3 was evaluated with respect to two assessment endpoints: 1) survival, growth, and emergence of macroinvertebrates associated with the benthic environment, and 2) protection of fish viability.

### **Survival, Growth, and Emergence of Organisms Associated with the Aquatic Environment:**

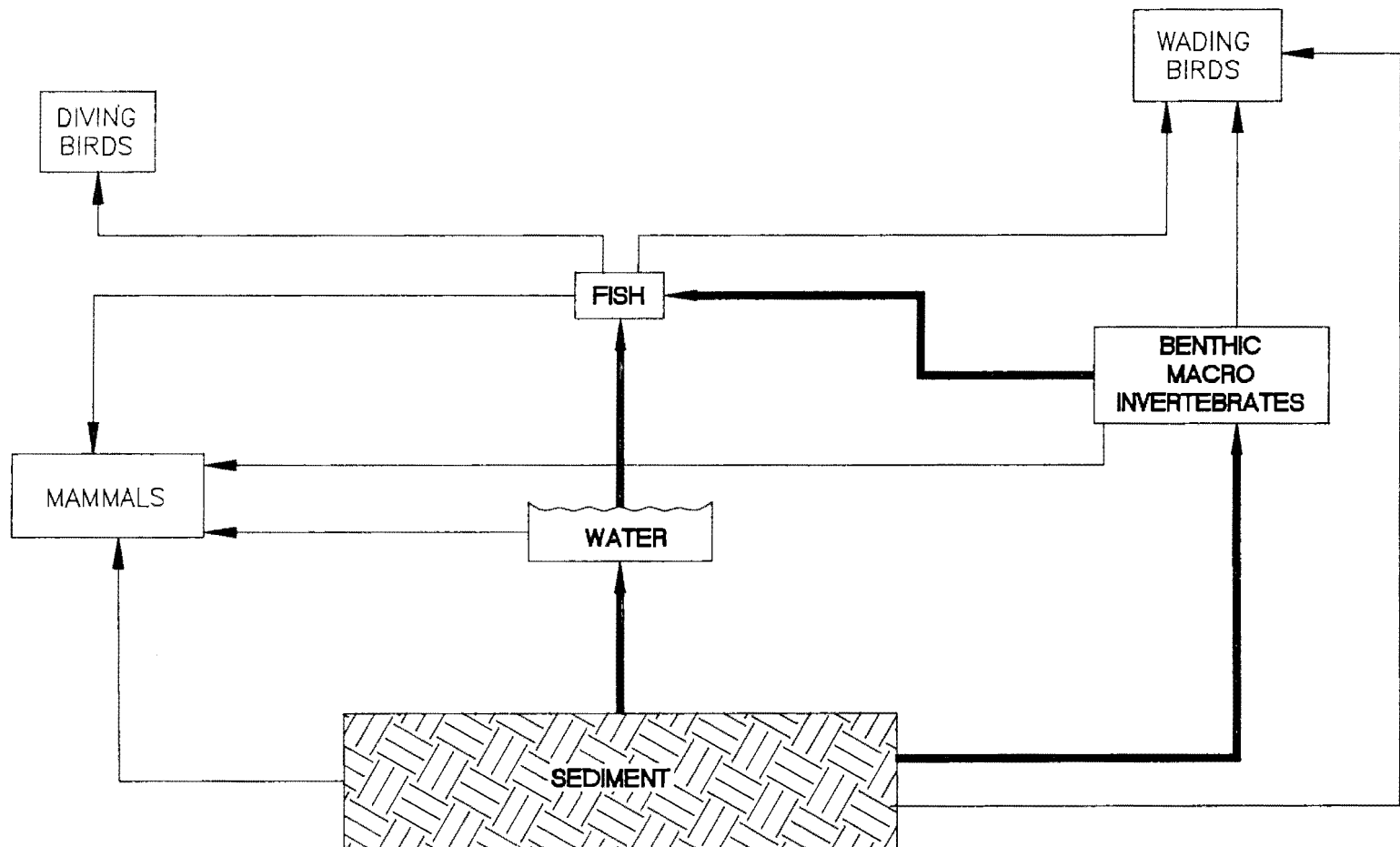
As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach for chemistry, toxicity, and diversity analysis. Results are scored via the decision making triad, and the overall condition of the wetland for this assessment endpoint is determined.

### **Sediment Chemistry**

As shown on Table 10-3-6, sediment HQ values are elevated for cadmium and DDD in particular in sample location 0307. However, the DDD concentration (49 ppb) is below its basewide concentration (50 ppb). Application of these sediment chemistry results to the decision making triad discussed in Section 7.14 revealed a matrix score of “+” for sediment chemistry.

### **Sediment Toxicity**

Survival results in the *Chironomus tentans* test were 83% for location 03-02, and 91% for location 03-07, as presented in Table 10-3-7. Statistical difference were noted in the weights collected at the end of the 10-day exposure at location 03-07 (location 03-02 2.9 mg, location 03-07 2.0 mg, [Table 10-3-7]). Midge larvae were maintained under optimum conditions for the next 18 days so emergence could be calculated. 50% of the control larvae, 60% of the larvae from location 03-02, and 70% of the larvae from location 03-07 emerged. Toxicity results are presented in Appendix E. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the chironomid test.



NOTE: BOLD LINES INDICATE  
COMPLETE PATHWAY



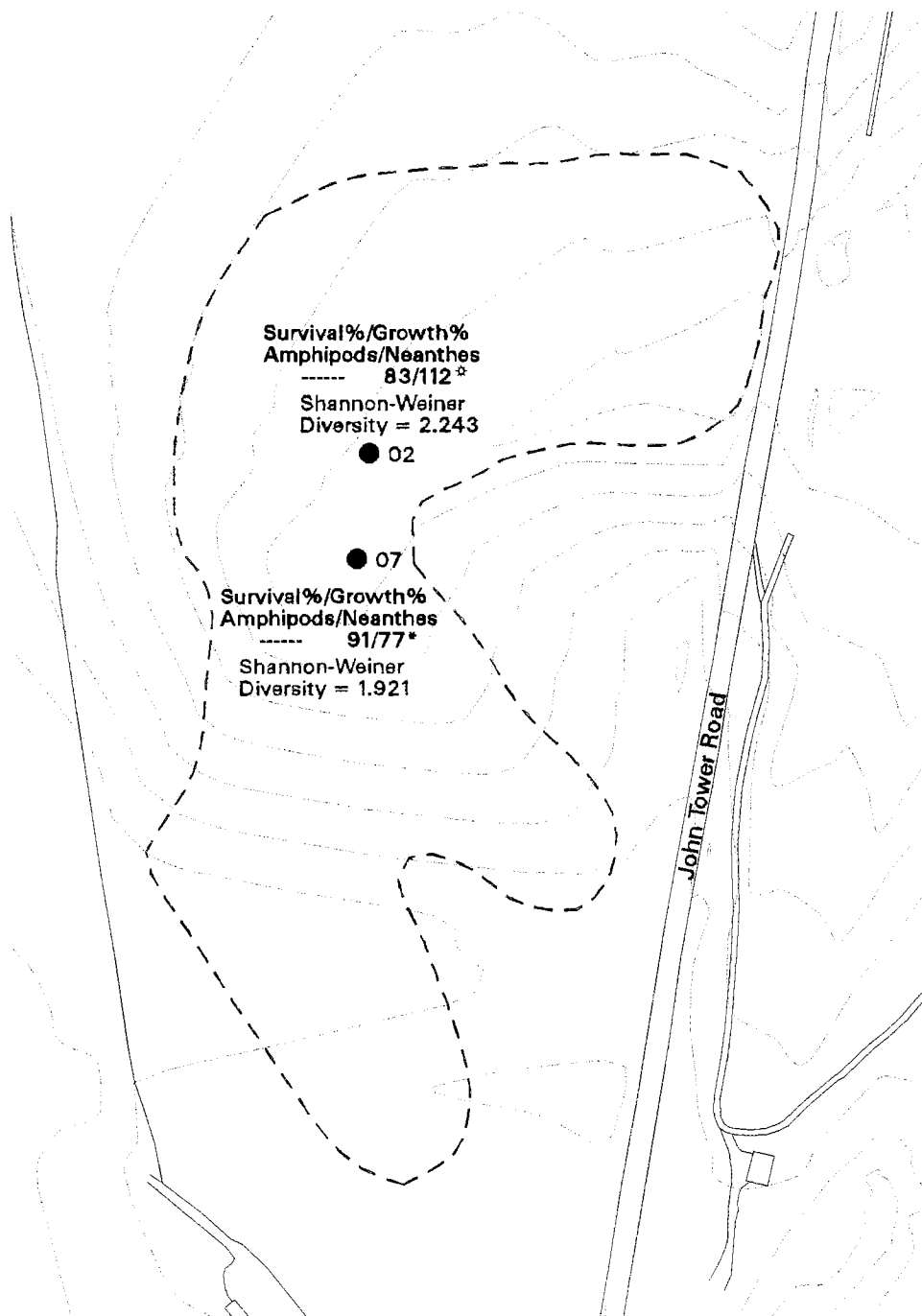
SITE 41 RI REPORT  
NAVAL AIR STATION PENSACOLA  
PENSACOLA, FLORIDA

FIGURE 10-3-2  
GROUP B: WETLAND 3  
CONCEPTUAL MODEL

DWG DATE: 03/11/99 DWG NAME: 0036S014

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- Sediment Sample Location
- Approximate Wetland Boundary

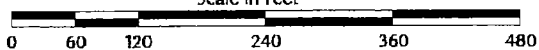
Notes:

Growth (%) is calculated by comparing to the bioassay exposed organism to the control organism performance.

\* indicates a statistically significant difference from the control organism.

\* indicates the organisms being tested out-performed the control organisms for this category.

Scale in Feet



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-3-3  
PHASE IIB WETLAND 3  
TOXICITY AND DIVERSITY RESULTS**

Table 10-3-6 (1)

## Wetland 3

## Phase IIB/III Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M030700</b>					
4,4'-DDT (UG/KG)		1.65	1.18	1.18	a
4,4'-DDE (UG/KG)		2.23	1.48	1.47	a
4,4'-DDD (UG/KG)		2.5	1.38	1.37	a
Chloride (MG/KG)		16.7	62.3	62.3	a
Chromium (MG/KG)		14.7	52.3	52.3	a
Copper (MG/KG)		14.6	15.7	15.6	a
Lead (MG/KG)		2.17	30.2	30.2	a
Mercury (MG/KG)		0.11	0.13	0.13	a
Nickel (MG/KG)		3.1	15.9	15.9	a
Silver (MG/KG)		0.42	0.73	0.73	a
Zinc (MG/KG)		19.4	124	124	a

**041M030701**

4,4'-DDT (UG/KG)	1.65	1.18	1.18	a
4,4'-DDE (UG/KG)	1.1	2.07	5.31	b
4,4'-DDD (UG/KG)	9.3	1.19	7.82	b
Arsenic (MG/KG)	1.2	7.24	0.58	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	500	182	2.75	b
Cadmium (MG/KG)	9.3	0.68	13.68	b
Chromium (MG/KG)	19	52.3	0.36	a b
Copper (MG/KG)	4	15.7	0.21	a b
gamma-Chlordane (UG/KG)	0.74	1.7	0.44	a
Lead (MG/KG)	35.6	30.2	1.18	a b
Mercury (MG/KG)	0.06	0.13	0.46	a b
Nickel (MG/KG)	3.1	15.9	0.19	a b
Silver (MG/KG)	0.42	0.73	0.58	b
Zinc (MG/KG)	234	124	1.89	a b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Table 10-3-7  
 Toxicity Test Results  
 Wetland 3 Sediment

Site	% Survival	Weight (mg)	Emergence	Triad Matrix Scoring
Control (negative)	91	2.7	50%	
Wetland 3 (03-02)	83	2.9	60%	—
Wetland 3 (03-07)	91	2.0*	70%	—

Note:

\* = Statistically significant difference from control population.

### Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. Location 03-02 exhibited a higher diversity (2.24), with more organisms (71), and a greater number of overall species (10) than location 03-07 (diversity 1.92, total organisms 5, and number of species 4). Wetland station 03-02 had representatives of the *Chironomus* and *Sphaerium* indicating the most dominant occurrence. *Tubifex tubifex*, an oligochaete, and *Culicoides*, an aquatic insect, were next in abundance. All the mentioned species may be found in a predominantly palustrine ecosystem. The diversity results are detailed in Appendix D. Benthic diversity results and application to the toxicity test results are presented in Table 10-3-8. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-3-8  
 Benthic Diversity Results and Application to the Triad Matrix Scoring  
 Wetland 3 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 3 (03-02)	2.24	0.97	9.77	—
Wetland 3 (03-07)	1.92	1.39	3.38	—

### Decision Making Triad Evaluations

Based on the ecological risk evaluation performed at Wetland 3, sediment and surface water results can be scored via the decision making triad, and the overall condition of the wetland for sediment and surface water can be determined.

Table 10-3-9 presents the interpretation of the triad analysis for the Wetland 3 Phase IIB/III sediment samples. Based on the results of the chemistry and toxicity data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

Table 10-3-9  
Triad Analysis Interpretation  
Wetland 3 Sediment

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 3	+	—	—	Contaminants are not bioavailable.

Condition number 3 denotes that Wetland 3 sediments are acceptable and no further action is recommended for sediment for this wetland.

### Protection of Fish Viability:

This assessment endpoint was evaluated using two lines of evidence, surface water toxicity and surface water chemistry. Tissue residue analysis was not conducted at this wetland because the shallow surface water depth will not support upper trophic level fish.

### Surface Water Toxicity

The first line of evidence was the acute and chronic toxicity to the fathead minnow (*Pimephales promelas*). Fathead minnows were exposed to surface water which was sampled at location 03-01. Survival (97.5%) at the site was high, and although lower, weights were not

significantly different when compared to the control fish (location 03-01 0.49 mg, control 0.58 mg). Application of the results to the decision matrix reveal a score of “—” for the toxicity testing. Fathead Minnow toxicity results and application to the matrix are shown in Table 10-3-10.

Table 10-3-10  
Fathead Minnow Toxicity Results  
Wetland 3 Surface Waters

Location	% Survival	Weight (mg)	Matrix Scoring
Control (negative)	100	0.58	
Wetland 3 (03-01)	97.5	0.49	—

*Note:*

\* = Statistically significant difference from control population.

### Surface Water Chemistry

The second line of evidence, comparison of surface water contaminants to water quality criteria, shows that an HQ greater than 1 is exceeded for iron as shown in Table 10-3-11. Application of surface water chemistry results to the decision matrix reveal a score of “+” for surface water chemistry. Although the HQ value for iron (19.60) was greater than 1 for surface water, a potential for toxic effects to fish is not anticipated because the toxicity results showed no chronic effects for survival, even with the slight reduction in weight among exposed species.

Table 10-3-12 presents the interpretation of the analysis for the Wetland 3 surface water sample. Based on the results of the chemistry and toxicity data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Surface Water, as discussed in Figure 7-3. Condition number 3 denotes that Wetland 3 surface water is acceptable and no further action is recommended for surface water for this wetland.

Table 10-3-11 (1)

## Wetland 3

## Phase IIB/III Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W030101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	59.10	87.00	0.68	a
	Antimony	UG/L	2.60	160.00	0.02	a
	Iron	UG/L	19600.00	1000.00	19.60	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

**Table 10-3-12**  
**Analysis Interpretation**  
**Wetland 3 Surface Water**

Location	Water Chemistry	Toxicity Test	Interpretation
Wetland 3	+	—	Contaminants are not bioavailable.

### **10.3.5 Human Health Risk Assessment**

#### **10.3.5.1 Samples Included**

##### **Sediment**

041M030101, 041M030201, 041M030301, 041M030401, 041M030501, 041M030601, 041M030701, 001M000301, 001M000302, 001M000303

##### **Surface Water**

041W030101, 041W030201, 041W030301, 041W030401, 01W000301, 01W000302, 01W000303

#### **10.3.5.2 Current and Future Land Use**

This wetland is not currently used by the Navy. Wetland 3 could be used by Navy personnel walking through the area or children who may find the area attractive. More than 50% of the sediment at Wetland 3 is exposed for most of the year, so assuming sediment exposure would be similar to soil exposure. Dermal contact could be a significant exposure pathway and was included in this HHRA. Based on the species present, depth of surface water, and habitat, fishing would not likely occur, and wading would be the most likely exposure scenario.

#### **10.3.5.3 Fish Tissue COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.3.5.4 Sediment COPCs Identified**

As shown in Table 10-3-13, the following COPC was identified:

- Arsenic

#### **10.3.5.5 Surface Water COPCs Identified**

As shown in Table 10-3-14, the following COPCs were identified:

- Aroclor 1260
- Arsenic
- Lead
- Methylene chloride

#### **10.3.5.6 Risk Characterization**

Tables 10-3-15 and 10-3-17 summarize cancer risk estimates for the sediment and surface water pathways. Arsenic was the only contributor to risk estimates for the sediment pathway while arsenic and Aroclor 1260 were the primary contributors to the surface water pathway. Table 10-3-19 summarizes risk and hazard estimates for Wetland 3. The cumulative risk estimated for this wetland is  $1.8E-5$ . The HI shown in Table 10-3-19 was estimated to be 0.17. Arsenic and Aroclor 1260 were identified as COCs in surface water and arsenic was identified as a COC in sediment. These constituents were identified as COCs based on their contribution to cumulative risk estimates for this wetland. Tables 10-3-15 through 10-3-18 detail cancer and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, hazard estimates were developed for completeness. Because of the shallow water depth and limited game fish habitat, fishing and subsequent fish tissue ingestion are unlikely at Wetland 3. However, physical and biological hazards of Wetland 3 could pose a risk to site trespassers. Quicksand and snakes are commonly encountered at this wetland.



TABLE 10-3-13  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

CAS Number	Chemical	(1)		(2)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(3)		(4)		Potential ARAR/TEC Source	COPC Flag	Rationale for Contaminant Detection or Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site (Residential) Screening Toxicity Value	Residential PBC for Soil			
95501	1,2-Dichlorobenzene	410 0000	J	410 0000	J	MG/KG	041M030201	1 / 10	400.00 - 2100.00	410.0	410	N/A	26000000	7000000	N	N/A	BSL
106467	1,4-Dichlorobenzene	58 0000	J	1400 0000	J	MG/KG	041M030201	4 / 10	400.00 - 2100.00	754.5	1400	N/A	970000	210000	C	N/A	BSL
78033	2-Ethylhexane (MEK)	180 0000	J	180 0000	J	MG/KG	041M030701	1 / 10	15.00 - 200.00	180.0	180	N/A	1900000000	47000000	N	N/A	BSL
72548	4,4'-DDE	1 3000	J	400.00	J	MG/KG	001M000300	16 / 10	NAV	40.4	400	N/A	93000	2700	C	N/A	BSL
72559	4,4'-DDE	0 8400	J	120 0000	J	MG/KG	041M030501	7 / 10	0.98 - 1.50	21.5	120	N/A	65000	1900	C	N/A	BSL
50293	4,4'-DDT	0 3200	J	220 0000	J	MG/KG	041M030701	9 / 10	1.10 - 1.10	27.1	220	N/A	65000	1900	C	N/A	BSL
83320	Acephenanthrene	98 0000	J	98 0000	J	MG/KG	041M030101	1 / 10	15.00 - 480.00	98.0	98	N/A	190000000	470000	N	N/A	BSL
57541	Acetone	1100 0000	J	1100 0000	J	MG/KG	041M030701	1 / 10	14.00 - 1600.00	1100.0	1100	N/A	32000000	760000	N	N/A	BSL
306002	Adrin	0 2300	J	1 0000	J	MG/KG	041M030301	3 / 10	0.01 - 11.00	0.6	1	N/A	1300	38	C	N/A	BSL
319846	alpha-BHC	0 1900	J	1 2000	J	MG/KG	041M030601	3 / 10	0.01 - 11.00	0.6	1.2	N/A	3500	100	C	N/A	BSL
5103719	alpha-Chlorodane	0 1700	J	2 2000	J	MG/KG	041M030201	8 / 10	0.02 - 0.05	0.8	2.2	N/A	63000	1600	C	N/A	BSL
7429905	Aluminum (Al)	428 0000	J	25000 00	J	MG/KG	041M030201	12 / 12	NAV	4287.9	25000	N/A	320000	7800	N	N/A	BSL
7440360	Antimony (Sb)	0 2300	J	44 0000	J	MG/KG	041M030301	5 / 12	0.13 - 9.40	11.9	44	N/A	130	3	N	N/A	BSL
11099025	Aroclor-1260	360 0000	DJ	360 0000	DJ	MG/KG	041M030301	1 / 10	2.40 - 226.00	350.0	350	N/A	11000	320	C	N/A	BSL
7440382	Aroclor (As)	0 5400	J	35 5000	J	MG/KG	001M000300	10 / 12	0.28 - 0.74	10.2	35.5	N/A	15	0.43	C	N/A	BSL
7440330	Boron (Ba)	1 0000	J	438 0000	J	MG/KG	001M000300	11 / 12	4.50 - 4.50	57.6	438	N/A	22000	560	N	N/A	BSL
71432	Benzene	18 0000	J	34 5000	J	MG/KG	041M030201	2 / 10	13.00 - 200.00	28.0	34	N/A	760000	22000	C	N/A	BSL
58553	Benzofurananthracene	23 0000	J	23 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	23.0	23	N/A	30000	660	C	N/A	BSL
50528	Benzofurananthracene	48 0000	J	190 0000	J	MG/KG	041M030101	2 / 10	46.00 - 480.00	114.0	190	N/A	3000	66	C	N/A	BSL
205922	Benzofurananthracene	65 0000	J	85 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	65.0	85	N/A	30000	660	C	N/A	BSL
191242	Benzofurananthracene	46 0000	J	46 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	46.0	46	N/A	2500000	230000	N	N/A	BSL
207089	Benzofurananthracene	27 0000	J	27 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	27.0	27	N/A	300000	6600	C	N/A	BSL
319857	Beta-BHC	0 7000	J	0 7000	J	MG/KG	041M030301	1 / 10	0.01 - 11.00	0.7	0.7	N/A	12000	350	C	N/A	BSL
117817	Beta-Ethylphenanthrene (BEPH)	75 0000	J	270 0000	J	MG/KG	041M030701	4 / 10	280.00 - 3000.00	161.0	270	N/A	1600000	46000	C	N/A	BSL
85667	Butylenephthalate	23 0000	J	23 0000	J	MG/KG	041M030101	1 / 10	54.00 - 3000.00	23.0	23	N/A	63000000	160000	N	N/A	BSL
7440439	Cadmium (Cd)	0 5200	J	72 7000	J	MG/KG	041M030201	7 / 12	0.19 - 1.30	12.6	72.7	N/A	320	8	N	N/A	BSL
7440702	Calcium (Ca)	350 0000	J	31600 00	J	MG/KG	001M000300	12 / 12	NAV	3573.5	31600	N/A	N/A	N/A	N	N/A	BSL
106207	Chlorobenzene	2 0000	J	620 0000	J	MG/KG	041M030101	5 / 10	13.00 - 200.00	192.3	620	N/A	6300000	160000	N	N/A	BSL
7440473	Chromium (Cr)	1 5000	J	1500 00	J	MG/KG	041M030401	12 / 12	NAV	33.2	1500	N/A	950	23	N	N/A	BSL
218019	Chrysene	32 0000	J	32 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	32.0	32	N/A	300000	66000	C	N/A	BSL
7440484	Cobalt (Co)	2 5000	J	2 5000	J	MG/KG	041M030201	1 / 12	0.16 - 4.70	2.5	2.5	N/A	19000000	470	N	N/A	BSL
7440508	Copper (Cu)	1 4000	J	68 4000	J	MG/KG	001M000300	7 / 12	0.96 - 3.92	17.1	68.4	N/A	13000000	310	N	N/A	BSL
57125	Cyanide (CN)	1 5000	J	5 1000	J	MG/KG	041M030501	2 / 10	0.00 - 5.20	3.3	5.1	N/A	6300000	160	N	N/A	BSL
319868	Gamma-BHC	0 1600	J	0 2800	J	MG/KG	041M030301	2 / 10	0.01 - 11.00	0.2	0.25	N/A	12000	350	C	N/A	BSL
63571	Dieldrin	6 0000	J	8 0000	J	MG/KG	041M030201	1 / 10	0.24 - 22.00	6.0	8	N/A	1400	40	C	N/A	BSL
84692	Diethylphthalate	47 0000	J	47 0000	J	MG/KG	041M030301	1 / 10	400.00 - 3000.00	47.0	47	N/A	25000000	6300000	N	N/A	BSL
84747	Dimethylphthalate	36 0000	J	77 0000	J	MG/KG	041M030101	2 / 10	420.00 - 3000.00	56.5	77	N/A	32000000	780000	N	N/A	BSL
117840	Dimethylphthalate	45 0000	J	45 0000	J	MG/KG	041M030201	2 / 10	420.00 - 3000.00	45.0	45	N/A	6300000	160000	N	N/A	BSL
1031018	Endosulfan sulfate	1 5000	J	1 7000	J	MG/KG	041M030701	2 / 10	0.24 - 22.00	1.6	1.7	N/A	1900000	47000	N	N/A	BSL
72208	Endrin	0 5300	J	1 0000	J	MG/KG	041M030101	4 / 10	0.24 - 22.00	1.2	1.8	N/A	95000	2300	N	N/A	BSL
53464705	Endrin ketone	1 4000	J	1 4000	J	MG/KG	041M030301	1 / 10	0.24 - 22.00	1.4	1.4	N/A	95000	2300	N	N/A	BSL
206440	Fluoranthene	46 0000	J	46 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	46.0	46	N/A	10000000	310000	N	N/A	BSL
86737	Fluorene	95 0000	J	95 0000	J	MG/KG	041M030201	1 / 10	19.00 - 480.00	95.0	95	N/A	13000000	310000	N	N/A	BSL
5102742	Gamma-Chlorodane	0 1100	J	1 7000	J	MG/KG	041M030201	3 / 10	0.02 - 11.00	0.9	1.7	N/A	63000	1900	C	N/A	BSL
193395	Indane(1,2,3-ethyl)ene	31 0000	J	31 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	31.0	31	N/A	30000	660	C	N/A	BSL
7439825	Iron (Fe)	1240 0000	J	306000 00	J	MG/KG	001M000300	12 / 12	NAV	78510	306000	N/A	N/A	N/A	N	N/A	BSL
7439921	Lead (Pb)	2 4000	J	101 0000	J	MG/KG	041M030501	10 / 12	1.90 - 14.30	20.9	101	N/A	400	400	N	OSWER	BSL
7439954	Magnesium (Mg)	20 2000	J	1420 0000	J	MG/KG	041M030401	9 / 12	33.90 - 270.00	272.9	1420	N/A	N/A	N/A	N	N/A	BSL
7439985	Manganese (Mn)	2 5000	J	1270 00	J	MG/KG	001M000300	12 / 12	NAV	149.3	1270	N/A	15000	1100	N	N/A	BSL
91203	Naphthalene	150 0000	J	150 0000	J	MG/KG	041M030201	1 / 10	40.00 - 480.00	150.0	150	N/A	13000000	310000	N	N/A	BSL
7440220	Nickel (Ni)	0 7800	J	0 7800	J	MG/KG	041M030401	1 / 12	0.95 - 18.60	0.8	0.78	N/A	6300	160	N	N/A	BSL
86018	Phenanthrene	24 0000	J	24 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	24.0	24	N/A	6500000	230000	N	N/A	BSL
130652	Phenol	55 0000	J	55 0000	J	MG/KG	001M000300	1 / 10	400.00 - 3000.00	55.0	55	N/A	19000000	4700000	N	N/A	BSL
7440307	Potassium (K)	10 0000	J	409 0000	J	MG/KG	041M030201	9 / 12	673.00 - 742.00	113.3	409	N/A	N/A	N/A	N	N/A	BSL
125030	Pyrene	43 0000	J	43 0000	J	MG/KG	041M030101	1 / 10	46.00 - 480.00	43.0	43	N/A	9500000	230000	N	N/A	BSL
7782432	Selenium (Se)	0 4400	J	5 3000	J	MG/KG	041M030101	4 / 12	0.16 - 4.40	1.9	3.3	N/A	1600	39	N	N/A	BSL
7440324	Silver (Ag)	10 5000	J	10 5000	J	MG/KG	041M030701	1 / 12	0.72 - 6.20	10.5	10.5	N/A	1600	35	N	N/A	BSL
7440235	Sodium (Na)	4 5600	J	251 0000	J	MG/KG	041M030501	7 / 12	2.50 - 212.00	93.3	251	N/A	N/A	N/A	N	N/A	BSL
109903	Toluene	2 0000	J	2 0000	J	MG/KG	041M030701	1 / 10	13.00 - 200.00	2.0	2	N/A	63000000	16000000	N	N/A	BSL
7440572	Vanadium (V)	1 2000	J	160 00	J	MG/KG	001M000300	12 / 12	NAV	16.6	160	N/A	2200	55	N	N/A	BSL
7440565	Zinc (Zn)	1 2000	J	287 00	J	MG/KG	041M030201	12 / 12	NAV	32.7	287	N/A	95000	2300	N	N/A	BSL

(1) Minimum/maximum detected concentration  
(2) Maximum concentration used as screening value  
(3) This chemical was not detected at background sampling location  
(4) RBCs for site trespasser scenario were calculated based on equations and parameters presented in Section 8 of this report  
(5) RBCs for residential scenario as presented in USEPA Regional Risk-Based Concentration Tables, 1998  
Office of Solid Waste and Emergency Response (OSWER)

(6) Rationale Codes  
Selection Reason: Above Screening Levels (ASL)  
Criterion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
External Hazard (EH)  
Not Available (NAV)

Definitions  
N/A = Not Applicable  
COPC = Chemical of Potential Concern  
ARAR/TEC = Applicable or Relevant and Appropriate Requirement To Be Considered  
J = Estimated Value  
C = Carcinogenic  
N = Noncarcinogenic

**TABLE 10-3-14**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 3 Surface Water

		(1)		(1)							(2)		(3)	(4)			(5)
CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	Background Value	Adolescent Site Trespasser Screening Toxicity Value	Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection
95501	1,2-Dichlorobenzene	1.000		1.0000		UG/L	041W030301	1 / 7	NAV	1.00	1	N/A	1300	6.4	N	N/A	BSL
106467	1,4-Dichlorobenzene	2.000	J	10.0000		UG/L	041W030301	6 / 7	NAV	4.00	10	N/A	430	0.47	C	N/A	BSL
7429905	Aluminum (Al)	98.6000		2150.0000		UG/L	041W030201	7 / 7	NAV	557.80	2150	N/A	120000	3700	N	N/A	BSL
7440360	Antimony (Sb)	3.000	J	3.3000	J	UG/L	041W030201	2 / 7	NAV	3.15	3.3	N/A	48	1.5	N	N/A	BSL
11096825	Aroclor-1260	0.500	J	0.5000	J	UG/L	041W030201	1 / 7	NAV	0.50	0.5	N/A	0.093	0.033	C	N/A	ASL
7440382	Arsenic (As)	2.700	J	48.9000		UG/L	041W030301	4 / 7	NAV	18.00	48.9	N/A	5.6	0.045	C	N/A	ASL
7440393	Barium (Ba)	27.6000	J	56.8000	J	UG/L	041W030301	7 / 7	NAV	37.61	56.8	N/A	8300	260	N	N/A	BSL
71432	Benzene	1.000	J	3.0000		UG/L	041W030401	5 / 7	NAV	1.80	3	N/A	91	0.36	C	N/A	BSL
7440439	Cadmium (Cd)	3.400	J	3.8000	J	UG/L	041W030301	2 / 7	NAV	3.60	3.8	N/A	60	1.8	N	N/A	BSL
7440702	Calcium (Ca)	22900.000		32600.0000		UG/L	041W030201	7 / 7	NAV	27800.00	32600	N/A	N/A	N/A	N	N/A	EN
108907	Chlorobenzene	3.000		30.0000	D	UG/L	041W030301	6 / 7	NAV	12.17	30	N/A	420	3.5	N	N/A	BSL
7440473	Chromium (Cr)	8.700	J	9.3000	J	UG/L	041W030301	2 / 7	NAV	9.00	9.3	N/A	360	11	N	N/A	BSL
7440508	Copper (Cu)	4.700	J	9.6000	J	UG/L	041W030301	2 / 7	NAV	7.15	9.6	N/A	4800	150	N	N/A	BSL
53494705	Endrin ketone	0.250	J	0.2500	J	UG/L	041W030201	1 / 7	NAV	0.25	0.25	N/A	10	1.1	N	N/A	BSL
7439896	Iron (Fe)	7810.000		176000.0000		UG/L	041W030301	7 / 7	NAV	42760.00	176000	N/A	N/A	N/A	N	N/A	EN
7439921	Lead (Pb)	1.900	J	20.3000		UG/L	041W030201	3 / 7	NAV	9.77	20.3	N/A	15	15	N	TTAL	ASL
7439954	Magnesium (Mg)	1540.000	J	2320.0000		UG/L	001W000302	7 / 7	NAV	2170.00	2320	N/A	N/A	N/A	N	N/A	EN
7439965	Manganese (Mn)	127.000		265.0000		UG/L	041W030201	7 / 7	NAV	167.43	265	N/A	2400	73	N	N/A	BSL
75092	Methylene chloride	120.000	D	1200.0000	D	UG/L	041W030101	2 / 7	NAV	660.00	1200	N/A	1000	4.1	C	N/A	ASL
91203	Naphthalene	1.000		1.0000		UG/L	041W030401	1 / 7	NAV	1.00	1	N/A	330	150	N	N/A	BSL
7440097	Potassium (K)	1380.000	J	1950.0000		UG/L	001W000301	7 / 7	NAV	1625.71	1950	N/A	N/A	N/A	N	N/A	EN
7440235	Sodium (Na)	5770.000		7420.0000		UG/L	001W000303	7 / 7	NAV	6522.86	7420	N/A	N/A	N/A	N	N/A	EN
7440622	Vanadium (V)	2.200	J	11.1000		UG/L	041W030301	4 / 7	NAV	6.13	11.1	N/A	830	26	N	N/A	BSL
7440666	Zinc (Zn)	10.400	J	10.4000	J	UG/L	041W030201	1 / 7	NAV	10.40	10.4	N/A	36000	1100	N	N/A	BSL
156592	cis-1,2-Dichloroethene	1.000		1.0000		UG/L	041W030401	1 / 4	NAV	1.00	1	N/A	670	61	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report

(4) PRGs for commercial maintenance worker scenario calculated using equations and parameters presented in Section 8 of this report

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Detection Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Not Available (NAV)

Treatment Technique Action Level (TTAL)

Definitions: N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-3-15  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 3  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	35.5	MG/KG	M	4.523E-08	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	2.41E-06
Dermal	Arsenic	35.5	MG/KG	M	1.854E-09	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	4.94E-07
Total Risk All Exposure Routes/Pathways									2.90E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-3-16  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future Medium: Sediment Exposure Medium: Sediment Exposure Point: Wetland 3 Receptor Population: Trespasser Receptor Age: Adolescent
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Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	35.5	MG/KG	M	3.17E-07	mg/kg-day	3.00E-04	mg/kg-day	0.037
Dermal	Arsenic	35.5	MG/KG	M	1.30E-08	mg/kg-day	6.00E-05	mg/kg-day	0.008
Total Hazard Index Across All Exposure Routes/Pathways									0.045

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-3-17  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface water  
Exposure Medium: Surface water  
Exposure Point: Wetland 3  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.0489	MG/L	N/A	M	2.88E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	4.32E-06
	Aroclor 1260	0.0005	MG/L	N/A	M	2.94E-08	mg/kg-day	0.4	(mg/kg-day) <sup>-1</sup>	1.18E-08
	Methylene chloride	1.2	MG/L	N/A	M	7.06E-05	mg/kg-day	0.0075	(mg/kg-day) <sup>-1</sup>	5.30E-07
Dermal	Arsenic	0.0489	MG/L	N/A	M	5.98E-07	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	4.49E-06
	Aroclor 1260	0.0005	MG/L	N/A	M	6.73E-06	mg/kg-day	0.8	(mg/kg-day) <sup>-1</sup>	5.38E-06
	Methylene chloride	1.2	MG/L	N/A	M	6.60E-05	mg/kg-day	0.009375	(mg/kg-day) <sup>-1</sup>	6.19E-07
Total Risk										1.53E-05

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-3-18  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 3  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.0489	MG/L	N/A	M	2.01E-05	mg/kg-day	3.00E-04	mg/kg-day	0.067
	Methylene chloride	1.2	MG/L	N/A	M	4.94E-04	mg/kg-day	6.00E-02	mg/kg-day	0.0082
Dermal	Arsenic	0.0489	MG/L		M	4.19E-06	mg/kg-day	6.00E-05	mg/kg-day	0.070
	Methylene chloride	1.2	MG/L		M	4.62E-04	mg/kg-day	4.80E-02	mg/kg-day	0.0096
<b>Total Hazard Index</b>										<b>0.15</b>

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-3-19  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Site Trespasser  
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient					
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total		
Sediment	Sediment	Wetland 3	Arsenic	2.41E-06	4.94E-07	2.90E-06	Arsenic	skin	0.017	0.0033	0.020		
			(Total)	2.41E-06	4.94E-07	2.90E-06			(Total)	0.017	0.0033	0.020	
Surface Water	Surface Water	Wetland 3	Arsenic	4.32E-06	4.49E-06	8.81E-06	Arsenic	skin	0.067	0.070	0.14		
			Aroclor 1260	1.18E-08	5.38E-06	5.40E-06			Methylene chloride	liver	0.0082	0.0096	0.018
			Methylene chloride	5.30E-07	6.19E-07	1.15E-06					(Total)	0.075	0.079
			(Total)	4.86E-06	1.05E-05	1.53E-05			(Total)				
Total Risk Across All Pathways						1.83E-05	Total Hazard Index Across All Pathways				0.17		

### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 3. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 3 surface water was considered additional to those they typically encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were retained to simulate background exposures in order to provide a conservative estimate of daily intake from sources unrelated to Wetland 3.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water, represented in the Lead Model as an alternate source. The bioavailability of lead ingested from the alternate source (Wetland 3 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of 20.3  $\mu\text{g/L}$ , the annual alternate source exposure was estimated to be 0.14  $\mu\text{g}$  lead/day. Table 10-3-20 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-3-4 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 2.7  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.26%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, surface water lead concentrations at Wetland 3 would not require specific action under the hypothetical exposure scenario.

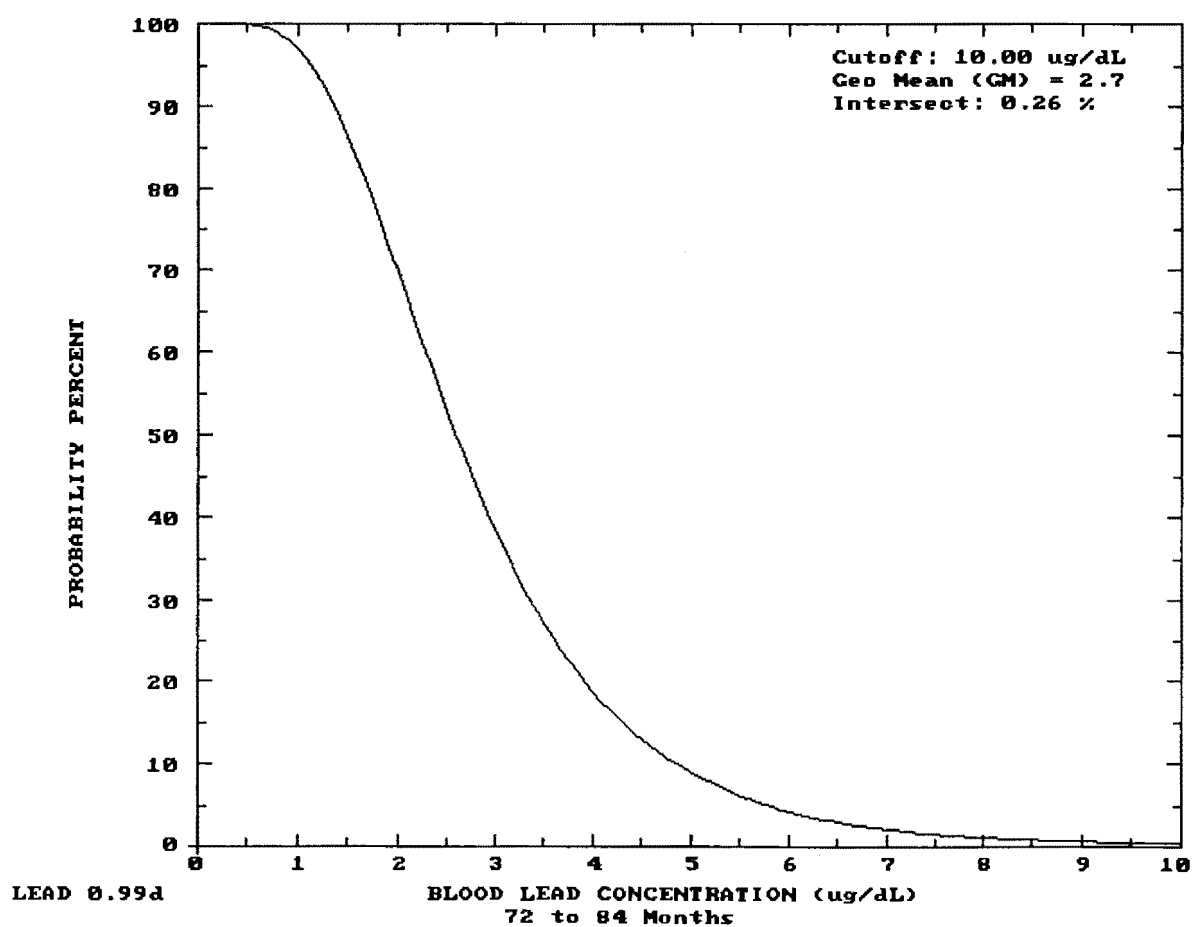


#### 10.3.5.7 Remedial Goal Options

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was the only COC identified at this wetland and was identified as a COC in both sediment and surface water. Because arsenic was identified as a COC for both media based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed. As shown in Table 10-3-11, the sediment exposure point concentration of 35.5 mg/kg-day resulted in a risk estimate of 2.9E-6 for arsenic. Using a linear ratio, a target risk of 1E-6 would result from 12.24 mg/kg. Therefore, 122.4 mg/kg and 1224 mg/kg represent target risks of 1E-5 and 1E-4, respectively.

The maximum arsenic concentration of 0.0489 mg/L in surface water resulted in a risk estimate of 8.8E-6, as shown in Table 10-3-17. Using a linear ratio, 0.0056 mg/L would correspond with a target risk of 1E-6. Therefore, 0.056 mg/L and 0.56 mg/L represent target risks of 1E-5 and 1E-4, respectively. The maximum Aroclor 1260 concentration of 0.0005 mg/L in surface water resulted in a risk estimate of 5.4E-6, as shown in Table 10-3-18. Using a linear ratio, 0.000093  $\mu$ g/L would correspond with a target risk of 1E-6. Therefore, 0.00093 mg/L and 0.0093 mg/L represent target risks of 1E-5 and 1E-4, respectively.

Figure 10-3-4 Probability Plots for Blood Lead Levels Wetland 3



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Table 10-3-20  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 3  
 Pensacola, Florida

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 3 surface water

6-7: 0.14  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil+Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	2.7	9.54	4.89	3.36	1.13	0.07	0.09

#### **10.3.6 Conclusions and Recommendations**

Wetland 3 was sampled as a Group B wetland during Phase IIB/III. Assessment endpoint and triad analyses from Phase IIB/III revealed that sediment and surface water were acceptable at Wetland 3. The HHRA identified arsenic as a sediment COPC, and Aroclor 1260, arsenic, lead, and methylene chloride as surface water COPCs at Wetland 3. No fish tissue COPCs were identified for this wetland. Under USEPA guidelines, surface water lead concentrations at Wetland 3 would not require specific action under the hypothetical exposure scenario. Since the wetland has no recreational value for fishing or swimming, and is generally restricted to public access, the potential for incidental ingestion of sediment or surface water is considered low. Because of the limited overall ecological risk in Wetland 3, the restricted access to human trespassing within the area, and the limited potential for sediment and surface water ingestion by trespassers, no further action is recommended for Wetland 3.

## **10.4 Wetland 4D**

### **10.4.1 Site Description**

Wetland 4D is in the northwest portion of the A.C. Read golf course, on the eastern half of NAS Pensacola. Wetland 4D receives surface water discharge from Wetland 3 to the west, Wetland 4C to the south, and is tidally influenced by Bayou Grande from the north. Site 1 is west of Wetland 4D, while Site 15 is east of this wetland.

Parsons and Pruitt (USEPA, 1991) described this area as an estuarine system containing emergent vegetation such as saw grass (*Cladium jamaicense*) and black needle rush (*Juncus roemerianus*). Wetland 4D receives freshwater from Wetlands 4A, 4B, 4C, and Wetland 3. Wetland 4A encompasses an irrigation reservoir for the golf course and drains into Bayou Grande through Wetlands 4B, 4C, and 4D. The open water portion of the Wetland 4D ranges from 1 to about 8 feet deep. Sediment in most of the wetland is sandy with a TOC of about 7%.

The IR sites potentially affecting Wetland 4D are Sites 1 and 15. Site 1 (sanitary landfill) was used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base. Site 15 (Pesticide Rinseate Disposal Site) was actively used from 1963 to 1979 as the disposal site for rinse water from pesticide mixing and spray equipment cleaning (NEESA, 1983).

### **10.4.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-4-1 denotes the Phase IIA Wetland 4D sampling locations.

#### **Sediment**

Twenty-one metals were detected in Wetland 4D sediment samples. Six metals exceeded sediment benchmark levels. Metals exceeding sediment benchmark levels included arsenic (12 ppm, 20 ppm, and 11 ppm at locations 04D1, 04D2, and 04D4), cadmium

(3.5 ppm, 3.7 ppm, and 2.8 ppm at locations 04D1, 04D2, and 04D4), chromium (70.2 ppm and 65.5 ppm at locations 04D1 and 04D2), copper (21.3 ppm, 45.8 ppm, and 27 ppm at locations 04D1, 04D2, and 04D4), lead (190 ppm, 348 ppm, and 162 ppm at locations 04D1, 04D2, and 04D4) and mercury (0.16 ppm at location 04D4). Eight pesticides were detected in Wetland 4D sediment samples: 4,4'-DDT and its metabolites, alpha/delta-BHC, dieldrin, endosulfan sulfate, and alpha-chlordane. 4,4'-DDD (110 ppb at location 04D4), 4,4'-DDE (46 ppb at location 04D1, and 65 ppb at location 04D4) exceeded basewide levels. Dieldrin (0.78 ppb and 1.1 ppb at locations 04D1 and 04D4, respectively) also exceeded the benchmark level (0.72 ppb). Three PCBs, including Aroclors-1248/1254/1260 were also detected. Aroclor-1254 at location 04D2 (42 ppb), and Aroclor-1260 at location 04D1 (50 ppb) exceeded the benchmark level for PCBs (21.6 ppb). Thirteen SVOCs were detected in Wetland 4D sediment samples, most of which were high- and low-molecular weight PAHs. Three phthalate esters were also detected. PAHs exceeding sediment benchmark levels included benzo(a)anthracene (130 ppb, 250 ppb, and 88 ppb at locations 04D1, 04D2, and 04D3), benzo(a)pyrene (190 ppb, 310 ppb, and 120 ppb at locations 04D1, 04D2, and 04D3), chrysene (150 ppb, 240 ppb, and 120 ppb at locations 04D1, 04D2, and 04D3), fluoranthene (280 ppb and 310 ppb at locations 04D1 and 04D2), and pyrene (260 ppb and 410 ppb at locations 04D1 and 04D2). The phthalate ester bis(2-ethylhexyl)phthalate was detected above its benchmark level (182 ppb) at location 04D2 (240 ppb). The VOCs acetone (a common laboratory contaminant) and carbon disulfide were also detected in Wetland 4D sediments.

Table 10-4-1 shows the Wetland 4D Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-4-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-4-2. The HQs will be further discussed in the ecological risk section.

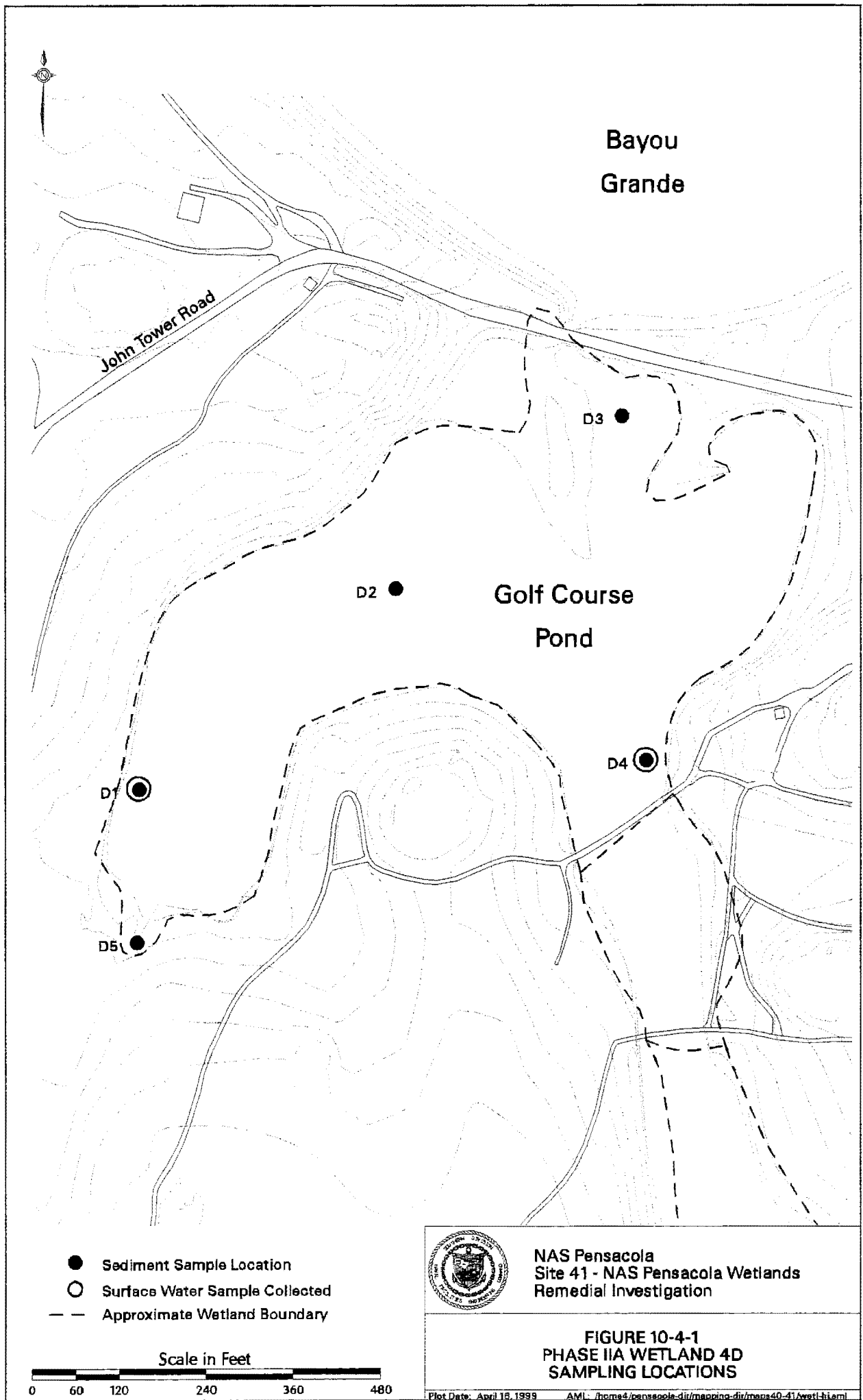




Table 10-4-1  
 Detected Concentrations in Wetland 4D Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	4/4	390 - 14700	7450.2
Antimony (Sb)	1/4	0.95	0.95
Arsenic (As)	5/5	0.49 - 20	8.80
Barium (Ba)	5/5	0.34 - 9	4.86
Beryllium (Be)	3/5	0.37 - 0.55	0.45
Cadmium (Cd)	4/5	0.26 - 3.7	2.57
Calcium (Ca)	5/5	26.3 - 4510	1786.86
Chromium (Cr)	5/5	0.74 - 70.2	36.25
Cobalt (Co)	3/5	1.1 - 2.1	1.6
Copper (Cu)	5/5	0.49 - 45.8	19.44
Iron (Fe)	5/5	671 - 39400	18842.2
Lead (Pb)	5/5	0.73 - 348	142.33
Magnesium (Mg)	5/5	19.6 - 4590	2032.12
Manganese (Mn)	5/5	2 - 69.3	42.14
Mercury (Hg)	2/4	0.12 - 0.16	0.14
Nickel (Ni)	3/5	6.1 - 6.7	6.3
Potassium (K)	5/5	18.4 - 1530	649.48
Selenium (Se)	3/5	1.5 - 2.3	1.87
Sodium (Na)	5/5	2.5 - 11800	4297.2
Vanadium (V)	5/5	0.9 - 38.7	17.5
Zinc (Zn)	5/5	1.4 - 102	51.02
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	3/5	15 - 110	52.67
4,4'-DDE	5/5	0.32 - 65	28.21
4,4'-DDT	4/5	1.5 - 3.9	2.63
Aroclor-1248	1/5	0.62	0.62
Aroclor-1254	2/5	1.7 - 42	21.85

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-4-1  
 Detected Concentrations in Wetland 4D Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Pesticides and PCBs (<math>\mu\text{g/kg}</math>)</b>			
Aroclor-1260	1/5	50	50
Dieldrin	2/5	0.78 - 1.1	0.94
Endosulfan sulfate	1/5	0.63	0.63
alpha-BHC	2/5	0.46 - 0.94	0.7
alpha-Chlordane	3/5	1 - 1.5	1.3
delta-BHC	4/5	0.11 - 16	7.28
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
Benzo(a)anthracene	3/5	88 - 250	156
Benzo(a)pyrene	3/5	120 - 310	206.67
Benzo(b)fluoranthene	3/5	160 - 380	260
Benzo(g,h,i)perylene	3/5	130 - 390	270
Butylbenzylphthalate	2/5	68 - 81	74.5
Carbazole	1/5	66	66
Chrysene	3/5	120 - 240	170
Diethylphthalate	1/5	71000	71000
Fluoranthene	3/5	110 - 310	233.33
Indeno(1,2,3-cd)pyrene	3/5	77 - 240	155.67
Phenanthrene	3/5	38 - 80	57
Pyrene	3/5	130 - 410	266.67
bis(2-Ethylhexyl)phthalate (BEHP)	4/5	61 - 240	133.75
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
Acetone	4/5	33 - 280	155.75
Carbon disulfide	3/5	4 - 27	16.33

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

**Table 10-4-2**  
**Welland 4D**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M04D101</b>					
4,4'-DDO (UG/KG)		38.00	1.22	31.19	a
4,4'-DDE (UG/KG)		46.00	2.07	22.01	b
4,4'-DDT (UG/KG)		1.00	1.19	1.65	b
alpha-Chlordane (UG/KG)		1.50	1.70	0.99	a
Arsenic (MG/KG)		20.00	7.24	2.75	a b
Benzo(a)anthracene (UG/KG)		260.00	74.8	3.34	b
Benzo(a)pyrene (UG/KG)		310.00	86.8	3.48	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		240.00	182	1.32	b
Cadmium (MG/KG)		3.7	0.68	5.44	b
Chromium (MG/KG)		65.5	52.3	1.25	a b
Chrysene (UG/KG)		240.00	108	2.22	b
Copper (MG/KG)		45.8	18.7	2.45	a b
Fluoranthene (UG/KG)		310.00	113	2.74	b
<b>041M04D201</b>					
4,4'-DDO (UG/KG)		15.00	1.22	12.30	b
4,4'-DDE (UG/KG)		28.00	2.07	14.01	b
4,4'-DDT (UG/KG)		2.20	1.19	1.65	b
alpha-Chlordane (UG/KG)		1.00	1.70	0.99	a
Antimony (MG/KG)		0.350	12	0.08	a
Aroclor-1254 (UG/KG)		42.00	21.6	1.94	b
Arsenic (MG/KG)		20.00	7.24	2.75	a b
Benzo(a)anthracene (UG/KG)		260.00	74.8	3.34	b
Benzo(a)pyrene (UG/KG)		310.00	86.8	3.48	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		240.00	182	1.32	b
Cadmium (MG/KG)		3.7	0.68	5.44	b
Chromium (MG/KG)		65.5	52.3	1.25	a b
Chrysene (UG/KG)		240.00	108	2.22	b
Copper (MG/KG)		45.8	18.7	2.45	a b
Fluoranthene (UG/KG)		310.00	113	2.74	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites:  
 Basewide level for 4,4'-DDE is 40 ppb  
 Basewide level for 4,4'-DDO is 50 ppb  
 Basewide level for 4,4'-DDT is 20 ppb

Table 10-4-2  
Wetland 4D  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	Lead (MG/KG)	348	30.2	11.52	a b
	Nickel (MG/KG)	6.7 J	15.9	0.42	a b
	Phenanthrene (UG/KG)	80 J	86.7	0.92	b
	Pyrene (UG/KG)	410	153	2.68	b
	Zinc (MG/KG)	102	124	0.82	a b

#### 041M04D301

4,4'-DDE (UG/KG)	0.72 J	2.07	0.35	b
4,4'-DDT (UG/KG)	1.5 J	1.19	1.26	b
Arsenic (MG/KG)	0.49 J	7.24	0.07	a b
Benzo(a)anthracene (UG/KG)	88	74.8	1.18	b
Benzo(a)pyrene (UG/KG)	120	88.8	1.35	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	61 J	182	0.34	b
Cadmium (MG/KG)	0.26 J	0.68	0.38	b
Chromium (MG/KG)	1.3	52.3	0.02	a b
Chrysene (UG/KG)	120	108	1.11	b
Copper (MG/KG)	2.6	18.7	0.14	a b
Fluoranthene (UG/KG)	110	113	0.97	b
Lead (MG/KG)	10.9	30.2	0.36	a b
Phenanthrene (UG/KG)	38 J	86.7	0.44	b
Pyrene (UG/KG)	130	153	0.85	b
Zinc (MG/KG)	3.6	124	0.03	a b

#### 041M04D401

4,4'-DDD (UG/KG)	110 D	1.22	90.16	b
4,4'-DDE (UG/KG)	65 DJ	2.07	31.40	b
4,4'-DDT (UG/KG)	3.9 J	1.19	3.28	b
alpha-Chlordane (UG/KG)	1.4 J	1.7	0.82	a
Arsenic (MG/KG)	11	7.24	1.52	a b
Cadmium (MG/KG)	2.8	0.68	4.12	b
Chromium (MG/KG)	43.5	52.3	0.83	a b
Copper (MG/KG)	27	18.7	1.44	a b
Dieldrin (UG/KG)	1.1 J	0.72	1.53	b
Lead (MG/KG)	162	30.2	5.36	a b
Mercury (MG/KG)	0.16 J	0.13	1.23	a b
Nickel (MG/KG)	6.1 J	15.9	0.38	a b
Zinc (MG/KG)	77.5	124	0.63	a b

#### 041M04D501

##### Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-4-2  
Wetland 4D  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
Keyhole (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1
Wetland (Wetland)		1.0	1.00	1.00	1

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb  
 Basewide level for 4,4'-DDD is 50 ppb  
 Basewide level for 4,4'-DDT is 20 ppb.

## Surface Water

Seven metals were detected in Wetland 4D surface water samples. Iron exceeded saltwater surface water criteria (300 ppb) at sample locations 04D1 (1,580 ppb) and 04D4 (695 ppb), as did thallium (6.3 ppb) at sample location 04D4 (11 ppb). No pesticides, PCBs, or SVOCs were detected in surface water at Wetland 4D. One VOC, methylene chloride (a common laboratory contaminant), was detected in Wetland 4D surface water, below its standard.

Table 10-4-3 shows the Wetland 4D Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-4-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with water quality criteria are presented in Table 10-4-4. The HQs will be further discussed ecological risk section.

Table 10-4-3  
 Detected Concentrations in Wetland 4D Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Calcium (Ca)	2/2	32600 - 55000	43800
Iron (Fe)	2/2	695 - 1580	1137.5
Magnesium (Mg)	2/2	63700 - 145000	104350
Manganese (Mn)	2/2	22.6 - 36.4	29.5
Potassium (K)	2/2	21500 - 45900	33700
Sodium (Na)	2/2	686000-1270000	978000
Thallium (Tl)	1/2	11	11
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Methylene chloride	1/2	87	87

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-4-4 (1)

## Wetland 4D

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W04D401	Saltwater	UG/L	695.0	300.0	2.31567	b
	Iron	UG/L	110	6.3	1.74603	b

## Notes

(a) USFPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### **10.4.3 Fate and Transport**

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data is lacking, many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-4-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-4-4.

#### **Transport Into the Wetland**

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 3 through this pathway:

- Potential storm water runoff and sediment entrainment from Site 1, Site 15, and the golf course. Additionally, this wetland has a direct connection to Bayou Grande, and may experience back flushing of surface water during high tide and storm surge events.

Sediment contaminants above benchmark levels (see Table 10-4-2) validate this sediment transport pathway, and by inference surface water as well. Additionally, one inorganic exceeded surface water criteria, further validating the pathway.

##### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential sources that would directly contribute contamination to Wetland 4D through this pathway are Site 1, Site 15, and the golf course.



Table 10-4-5  
 Calculated Sediment Screening Values for Wetland 4D

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Arsenic	36 <sup>a</sup>	2.9E+01	105	20	NO
Cadmium	9.3 <sup>a, b</sup>	7.5E+01	69.9	3.7	NO
Chromium	50 <sup>a, b</sup>	1.9E+01	95.7	70.2	NO
Copper	2.9 <sup>a, b</sup>	4.3E+02	125	45.8	NO
Lead	5.6 <sup>b</sup>	9E+02	504	348	NO
Mercury	0.025 <sup>a, b</sup>	5.2E+01	0.13	0.16	YES
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	0.14 <sup>a</sup>	1.34E+05	1.88E+06	65	NO
4,4 DDD	0.025 <sup>a</sup>	3.00E+04	7.50E+04	110	NO
4,4 DDT	0.001 <sup>a, b</sup>	7.88E+04	7.88E+03	2.9	NO
Dieldrin	0.0019 <sup>a, b</sup>	642	1.22E+02	1.1	NO
Total PCBs*	0.03 <sup>a, b</sup>	9.251E+03	2.78E+04	94.32	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	1.19E+04	3.69E+04	250	NO
Benzo(a)pyrene	0.031 <sup>b</sup>	3.06E+04	9.51E+04	310	NO
Chrysene	0.031 <sup>b</sup>	1.19E+04	3.69E+04	240	NO
Fluoranthene	1.6 <sup>a</sup>	3.21E+03	5.14E+05	310	NO
Pyrene	11,000 <sup>b</sup>	3.14E+03	3.45E+09	410	NO

**Notes:**

\* = based on Aroclor-1260

Kd for organics calculated using foc of 0.030 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class II Water Quality Criteria (1996).

Contamination found in groundwater validates this pathway.

## **Transport Within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment transport will occur to the north into Bayou Grande. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

### *Sediment Leaching to Surface Water Pathway*

Ten organics — four pesticides, PCBs, five semivolatiles — and six inorganics exceeded their SSV (see Table 10-4-2), but only one — mercury — exceeded its calculated SSL (see Table 10-4-5).

Mercury was not detected in the corresponding surface water, thus the potential for their partitioning to surface water is considered low. Iron was the only constituent in surface water above standards, and it is likely attributable to the surface water/groundwater discharge pathway. Because mercury was detected in sediment above their SSLs, the pathway is considered valid, but with a low potential for partitioning to surface water.

## **Transport From the Wetland**

Surface water and sediment from Wetland 4D can be expected to move directly into Bayou Grande, with some landward movement during periods of high tide and storm surge events. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

### **10.4.4 Ecological Risk Assessment**

HQs for Wetland 4D sediment samples are presented in Tables 10-4-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic (1.66, 2.76, and 1.52 at locations 04D1, 04D2, and 04D4), cadmium (5.15, 5.44, and 4.12 at locations 04D1, 04D2, and 04D4), chromium (1.34 and 1.25 at locations 04D1 and 04D2), copper

(1.14, 2.45, and 1.44 at locations 04D1, 04D2, and 04D4), lead (6.29, 11.52, and 5.36 at locations 04D1, 04D2, and 04D4) and mercury (1.23 at location 04D4). 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT each had HQs above 1 at locations 04D1 (27.05, 22.22, and 2.44), 04D2 (12.30, 14.01, and 1.85), and 04D4 (90.16, 31.40, and 3.28). 4,4'-DDT also had a HQ above 1 at sample location 04D3 (1.26). Dieldrin (1.08 and 1.53 at locations 04D1 and 04D4, respectively) also had an HQ greater than 1. The PCBs Aroclor 1254 and Aroclor-1260 also had HQs greater than 1 at locations 04D2 (1.94), and 04D1 (2.31), respectively. PAHs with HQs above 1 included benzo(a)anthracene (1.74, 3.34, and 1.18 at locations 04D1, 04D2, and 04D3), benzo(a)pyrene (2.14, 3.49, and 1.35 at sample locations 04D1, 04D2, and 04D3), chrysene (1.39, 2.22, and 1.11 at sample locations 04D1, 04D2, and 04D3), fluoranthene (2.48 and 2.74 at sample locations 04D1 and 04D2), and pyrene (1.70 and 2.68 at locations 04D1 and 04D2). The phthalate ester bis(2-ethylhexyl)phthalate had an HQ above 1 at location 04D2 (1.32). Phase IIA surface water results revealed HQs greater than 1 for iron at sample locations 04D1 (5.27) and 04D4 (2.32), and thallium at sample location 04D4 (1.75). HQs greater than 1 indicate the potential for excess risk.

### **Phase IIB/III**

Based on Phase IIA data, Wetland 4D was classified in Group C. Wetlands 18 and 16 were selected to represent Group C because they had the highest levels of contamination in the group. Color-codes, groupings and rationale for classification are described in Section 7.

Risk in Wetland 16 was evaluated with respect to one assessment endpoint, survival, growth, and reproduction of macroinvertebrates associated with the benthic environment. Decision making triad results for Phase IIB/III Wetland 16 sediment analytical results (condition number 2) indicated that Wetland 16 sediment was acceptable and no further action was recommended for this medium. See Section 10.5.4 for a more detailed presentation of the Wetland 15 results.

Wetland 18 assessment endpoints were 1) piscivorous bird health and reproduction; 2) survival, growth, and reproduction of macroinvertebrates associated with the benthic environment; and 3) protection of fish viability. Analyses of the data suggest that the detected concentrations in sediment and surface water are acceptable. See Section 10.6.4 for a more detailed presentation of the Wetland 18 analysis.

Comparison of Wetland 4D to the Group C representative wetlands (Wetlands 16 and 18) should indicate that Wetland 4D would have similar results for sediment and surface water. Ecological risk for sediment and surface water at Wetland 4D should therefore be considered acceptable.

#### **10.4.5 Human Health Risk Assessment**

##### **10.4.5.1 Samples Included**

###### **Sediment**

041M04D101, 041M04D201, 041M04D301, 041M04D401, 041M04D501

###### **Surface Water**

041W04D101, 041W04D401

##### **10.4.5.2 Current and Future Land Use**

This wetland is on the Navy golf course and could be an exposure point for golfers or trespassers looking for lost golf balls. The Navy enforces the no fishing/no swimming policy at this wetland. The adolescent trespasser and maintenance worker scenarios were considered conservatively representative of potential human receptors at this wetland.

##### **10.4.5.3 Fish COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.4.5.4 Sediment COPCs Identified**

As shown in Table 10-4-6, the following COPC was identified:

- Arsenic

#### **10.4.5.5 Surface Water COPCs Identified**

As shown in Table 10-4-7, no surface water COPCs were identified.

#### **10.4.5.6 Risk Characterization**

##### ***Adolescent Trespasser***

As shown in Table 10-4-8, arsenic is the only contributor to sediment risk estimates for the trespasser scenario. The cumulative risk (ingestion and dermal contact) estimated for this wetland is  $1.7E-6$ . The HI shown in Table 10-4-9 was estimated to be 0.026. Arsenic was identified as a COC in sediment based on its contribution to the cumulative risk estimate for this wetland using the adolescent trespasser scenario. Table 10-4-12 summarizes cancer risk estimates and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below. Risk managers should also consider ecological endpoints.

##### ***Maintenance Worker***

As shown in Table 10-4-10, arsenic is the only contributor to sediment risk estimates for the maintenance worker scenario. The cumulative risk (ingestion and dermal contact) estimated for this wetland is  $2.7E-6$ . The HI shown in Table 10-4-11 was estimated to be 0.072. Arsenic was identified as a COC in sediment based on its contribution to the cumulative risk estimate for this wetland using the maintenance worker scenario. Tables 10-4-12 details cancer risk estimates and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below. Risk managers should also consider ecological endpoints.

TABLE 10-4-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 4d Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	15.0000	DJ	110.0000	D	UG/KG	041M04D401	3 / 5	0.21 - 0.21	52.67	110	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	0.3200		65.00	D	UG/KG	041M04D501	5 / 5	NAV	28.21	65	N/A	65000	40000	C	N/A	NO	BSL
50293	4,4'-DDT	1.5000	J	3.9000	J	UG/KG	041M04D301	4 / 5	0.21 - 0.21	2.63	3.9	N/A	65000	40000	C	N/A	NO	BSL
67641	Acetone	33.0000		280.0000		UG/KG	041M04D401	4 / 5	250.00 - 250.00	155.75	280	N/A	32000000	49000000	N	N/A	NO	BSL
319846	alpha-BHC	0.4600	J	0.9400	J	UG/KG	041M04D301	2 / 5	0.01 - 0.04	0.70	0.94	N/A	3500	2200	C	N/A	NO	BSL
5103719	alpha-Chlordane	1.0000	J	1.5000	J	UG/KG	041M04D201	3 / 5	0.01 - 0.01	1.30	1.5	N/A	63000	39000	C	N/A	NO	BSL
7429905	Aluminum (Al)	390.0000		33400.00		MG/KG	041M04D401	6 / 6	NAV	11775.17	33400	N/A	320000	4900000	N	N/A	NO	BSL
7440360	Antimony (Sb)	0.9500	J	0.9500	J	MG/KG	041M04D201	1 / 6	0.12 - 18.20	0.95	0.95	N/A	130	200	N	N/A	NO	BSL
12672266	Aroclor-1248	0.6200	J	0.6200	J	UG/KG	041M04D201	1 / 5	2.10 - 7.70	0.62	0.62	N/A	11000	6900	C	N/A	NO	BSL
11097691	Aroclor-1254	1.7000	J	42.0000	J	UG/KG	041M04D501	2 / 5	2.10 - 7.70	21.85	42	N/A	11000	6900	C	N/A	NO	BSL
11096825	Aroclor-1260	50.0000	J	50.0000	J	UG/KG	041M04D201	1 / 5	2.10 - 7.70	50.00	50	N/A	11000	6900	C	N/A	NO	BSL
7440382	Arsenic (As)	0.4900	J	20.40	J	MG/KG	041M04D301	6 / 6	NAV	10.73	20.4	N/A	15	9.2	C	N/A	YES	ASL
7440393	Banum (Ba)	0.3400	J	59.00	J	MG/KG	041M04D101	6 / 6	NAV	13.89	59	N/A	22000	34000	N	N/A	NO	BSL
56553	Benzo(a)anthracene	88.0000		250.0000		UG/KG	041M04D401	3 / 5	41.00 - 1300.00	156.00	250	N/A	30000	19000	C	N/A	NO	BSL
50328	Benzo(a)pyrene	120.0000		310.0000		UG/KG	041M04D301	3 / 5	41.00 - 1300.00	206.67	310	N/A	3000	1800	C	N/A	NO	BSL
205962	Benzo(b)fluoranthene	160.0000		380.0000		UG/KG	041M04D201	3 / 5	41.00 - 1300.00	260.00	380	N/A	30000	19000	C	N/A	NO	BSL
191242	Benzo(g,h,i)perylene	130.0000		390.0000		UG/KG	041M04D101	3 / 5	41.00 - 1300.00	270.00	390	N/A	95000000	15000000	N	N/A	NO	BSL
207086	Benzo(k)fluoranthene	100.0000		230.0000		UG/KG	041M04D401	3 / 5	41.00 - 1300.00	156.67	230	N/A	300000	190000	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.3700	J	0.8100	J	MG/KG	041M04D401	4 / 6	0.06 - 0.06	0.54	0.81	N/A	630	980	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	61.0000	J	240.0000	J	UG/KG	041M04D201	4 / 5	13000.00 - 13000.00	133.75	240	N/A	1600000	980000	C	N/A	NO	BSL
85687	Butylbenzylphthalate	68.0000	J	81.0000	J	UG/KG	041M04D101	2 / 5	400.00 - 13000.00	74.50	81	N/A	63000000	98000000	N	N/A	NO	BSL
7440439	Cadmium (Cd)	0.2600	J	3.7000	J	MG/KG	041M04D201	4 / 6	0.18 - 1.00	2.57	3.7	N/A	320	490	N	N/A	NO	BSL
7440702	Calcium (Ca)	26.3000	J	4510.00	J	MG/KG	041M04D501	6 / 6	NAV	2065.72	4510	N/A	N/A	N/A	N/A	N/A	NO	EN
86748	Carbazole	66.0000	J	66.0000	J	UG/KG	041M04D101	1 / 5	400.00 - 13000.00	66.00	66	N/A	1100000	690000	C	N/A	NO	BSL
75150	Carbon disulfide	4.0000	J	27.0000	J	UG/KG	041M04D401	3 / 5	12.00 - 14.00	16.33	27	N/A	32000000	45000000	N	N/A	NO	BSL
7440473	Chromium (Cr)	0.7400		85.10		MG/KG	041M04D501	6 / 6	NAV	44.39	85.1	N/A	1600	2500	N	N/A	NO	BSL
218019	Chrysene	120.0000		240.0000		UG/KG	041M04D401	3 / 5	41.00 - 1300.00	170.00	240	N/A	3000000	1900000	C	N/A	NO	BSL
7440484	Cobalt (Co)	1.1000	J	2.1000	J	MG/KG	041M04D201	3 / 6	0.18 - 5.80	1.60	2.1	N/A	19000	29000	N	N/A	NO	BSL
7440508	Copper (Cu)	0.4900	J	53.00	J	MG/KG	041M04D501	6 / 6	NAV	25.03	53	N/A	13000	20000	N	N/A	NO	BSL
319868	delta-BHC	0.1100	J	16.0000	DJ	UG/KG	041M04D301	4 / 5	0.01 - 0.01	7.28	16	N/A	12000	7600	N/A	N/A	NO	BSL
60571	Dieldrin	0.7800	J	1.1000	J	UG/KG	041M04D401	2 / 5	0.21 - 0.68	0.94	1.1	N/A	1400	860	C	N/A	NO	BSL
84662	Diethylphthalate	71000.0000	J	71000.0000	J	UG/KG	041M04D401	1 / 5	400.00 - 1300.00	71000.00	71000	N/A	250000000	390000000	N	N/A	NO	BSL
1031078	Endosulfan sulfate	9.6300	J	0.6300	J	UG/KG	041M04D201	1 / 5	0.21 - 0.77	0.63	0.63	N/A	1900000	2900000	N	N/A	NO	BSL
206440	Fluoranthene	110.0000		310.0000		UG/KG	041M04D301	3 / 5	41.00 - 1300.00	233.33	310	N/A	13000000	20000000	N	N/A	NO	BSL
193355	Indeno(1,2,3-cd)pyrene	77.0000		240.0000		UG/KG	041M04D301	3 / 5	41.00 - 1300.00	155.67	240	N/A	30000	19000	C	N/A	NO	BSL
7439896	Iron (Fe)	671.0000		47500.00		MG/KG	041M04D401	6 / 6	NAV	23618.50	47500	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	0.7300		350.00	J	MG/KG	041M04D501	6 / 6	NAV	176.94	350	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	19.8000	J	5170.00	J	MG/KG	041M04D301	6 / 6	NAV	2555.10	5170	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	2.0000	J	90.20	J	MG/KG	041M04D301	6 / 6	NAV	50.15	90.2	N/A	15000	23000	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.1200	J	0.1600	J	MG/KG	041M04D101	2 / 6	0.05 - 0.15	0.14	0.16	N/A	95	150	N/A	N/A	NO	BSL
7440020	Nickel (Ni)	6.1000	J	12.8000	J	MG/KG	041M04D201	4 / 6	0.72 - 0.74	7.93	12.8	N/A	6300	9800	N	N/A	NO	BSL
85018	Phenanthrene	38.0000	J	80.0000	J	UG/KG	041M04D301	3 / 5	41.00 - 1300.00	57.00	80	N/A	9500000	15000000	N	N/A	NO	BSL
7440097	Potassium (K)	18.4000	J	3150.00	J	MG/KG	041M04D301	6 / 6	NAV	1068.23	3150	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	130.0000		410.0000		UG/KG	041M04D101	3 / 5	41.00 - 1300.00	266.67	410	N/A	9500000	15000000	N	N/A	NO	BSL
7782492	Selenium (Se)	1.5000	J	4.6000	J	MG/KG	041M04D101	4 / 6	0.18 - 0.18	2.55	4.6	N/A	1600	2500	N	N/A	NO	BSL
7440235	Sodium (Na)	2.5000	J	11800.00	J	MG/KG	041M04D401	6 / 6	NAV	5381.56	11800	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	0.9000	J	59.10	J	MG/KG	041M04D301	6 / 6	NAV	24.43	59.1	N/A	2200	3400	N	N/A	NO	BSL
7440566	Zinc (Zn)	1.4000		112.00		MG/KG	041M04D501	6 / 6	NAV	61.18	112	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background concentrations were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BLG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-4-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 4D Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser Screening Toxicity Value	(4) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Selection or Deletion
7440702	Calcium (Ca)	32600.00		55000.00		UG/L	041W04D401	2 / 2	NAV	43800.00	55000	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	695.00		1580.00		UG/L	041W04D101	2 / 2	NAV	1137.50	1580	N/A	N/A	N/A	N	NO	EN
7439954	Magnesium (Mg)	63700.00		145000.00		UG/L	041W04D401	2 / 2	NAV	104350.00	145000	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	22.60		36.40		UG/L	041W04D101	2 / 2	NAV	29.50	36.4	N/A	2400	5000	N	NO	BSL
75092	Methylene chloride	87.00		87.00	D	UG/L	041W04D401	1 / 2	NAV	87.00	87	N/A	1000	900	C	NO	BSL
7440097	Potassium (K)	21500.00		45900.00		UG/L	041W04D401	2 / 2	NAV	33700.00	45900	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	686000.00		1270000.00		UG/L	041W04D401	2 / 2	NAV	978000.00	1270000	N/A	N/A	N/A	N/A	NO	EN
7440280	Thallium (Tl)	11.00		11.00		UG/L	041W04D401	1 / 2	NAV	11.00	11	N/A	17	28	N	YES	ASL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report

(5) PRGs for commercial maintenance worker calculated using equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-4-8  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 4d  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	20.4	MG/KG	N/A	M	9.20E-07	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	1.38E-06
Dermal	Arsenic	20.4	MG/KG	N/A	M	3.80E-08	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	2.85E-07
Total Risk All Exposure Routes/Pathways										1.67E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



TABLE 10-4-9  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 4d  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	20.4	MG/KG	N/A	M	6.50E-06	mg/kg-day	3.00E-04	mg/kg-day	0.022
Dermal	Arsenic	20.4	MG/KG	N/A	M	2.60E-07	mg/kg-day	6.00E-05	mg/kg-day	0.0043
Total Hazard Index Across All Exposure Routes/Pathways										0.026

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-4-10  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 4d  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	20.4	MG/KG	N/A	M	1.50E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	2.25E-06
Dermal	Arsenic	20.4	MG/KG	N/A	M	6.10E-08	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	4.58E-07
Total Risk All Exposure Routes/Pathways										2.71E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-4-11  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 4d  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	20.4	MG/KG	N/A	M	4.16E-06	mg/kg-day	3.00E-04	mg/kg-day	0.014
Dermal	Arsenic	20.4	MG/KG	N/A	M	1.70E-07	mg/kg-day	6.00E-05	mg/kg-day	0.0028
Total Hazard Index Across All Exposure Routes/Pathways										0.017

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-4-12  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Site Trespasser  
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal	Total		Primary Target Organ	Ingestion	Dermal	Total
Sediment	Sediment	Wetland 4d	Arsenic	1.38E-06	2.85E-07	1.67E-06	Arsenic	skin	0.022	0.0043	0.0260
			(Total)	1.38E-06	2.85E-07	1.67E-06	(Total)	0.022	0.0043	0.0260	
Total Risk Across All Exposure Pathways						1.67E-06	Total Hazard Index Across All Exposure Pathways				0.0260

Scenario Timeframe: Current  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal	Total		Primary Target Organ	Ingestion	Dermal	Total
Sediment	Sediment	Wetland 4d	Arsenic	2.25E-06	4.58E-07	2.71E-06	Arsenic	skin	0.014	0.0028	0.017
			(Total)	2.25E-06	4.58E-07	2.71E-06	(Total)		0.014	0.0028	0.017
Total Risk Across All Exposure Pathways						2.71E-06	Total Hazard Index Across All Exposure Pathways				0.017

#### **10.4.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was the only COC identified for this wetland. Because arsenic was identified as a COC for sediment based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed.

##### ***Adolescent Trespasser***

As shown in Table 10-4-8, the sediment EPC of 20.4 mg/kg-day resulted in a risk estimate of 1.7E-6 for arsenic. Using a linear ratio, a target risk of 1E-6 would result from 12.2 mg/kg. Therefore, 122 mg/kg and 1220 mg/kg represent target risks of 1E-5 and 1E-4, respectively.

##### ***Maintenance Worker***

A sediment EPC of 20.4 mg/kg resulted in a risk estimate of 2.7E-6, as shown in Table 10-4-10. Using a linear ratio, 7.61 mg/kg would correspond with a target risk of 1E-6. Therefore, 76.1 mg/kg and 761 mg/kg represent target risks of 1E-5 and 1E-4, respectively. The only surface water quality standard exceeded in Wetland 4D was for iron.

#### **10.4.6 Conclusions and Recommendations**

Wetlands 16 and 18 were sampled to represent the Group C wetlands in Phase IIB/III. Wetland 4D has similar contaminants (metals and pesticides/PCBs) as Wetlands 16 and 18, and is also tidally influenced by Bayou Grande. Comparison of Wetland 4D to the Group C representative wetlands (Wetlands 16 and 18) indicate no excess risk for sediment and surface water at Wetland 4D is considered acceptable.

The HHRA identified arsenic in sediment as the only COPC identified at Wetland 4D. However, Wetland 4D's location within the A.C. Read golf course effectively restricts its access by trespassers. Though the wetland could be attractive for recreational swimming and fishing, the

Navy enforces a no fishing/no swimming policy at Wetland 4D. Since the wetland is restricted to swimming, the potential for incidental ingestion of sediment is considered low. In addition, the arsenic detected concentrations may be linked to pesticides applied on the golf course in accordance with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Because of the lack of excess ecological risk in Wetland 4D, the limited possibilities for incidental ingestion of sediment from the wetland, no further action is recommended for Wetland 4D.

## **10.5 Wetland 16**

### **10.5.1 Site Description**

Wetland 16 is on the northeastern side of Site 1, along the shore of Bayou Grande. The NAS Pensacola picnic ground lies to the east. Parsons and Pruitt (USEPA, 1991) described this area as an estuarine emergent system containing predominantly black needlerush (*Juncus roemerianus*). The wetland also contains saw grass (*Cladium jamaicense*). Wetland 16 generally flows northwest into Bayou Grande through a drainage channel about 3 feet wide. The open water portion of the wetland ranges from 1 to about 4 feet deep and has a maximum width of about 200 feet. Sediment in most of the wetland is sandy, with TOC detected at 6%. Wetland 16 is fed from the east and south by groundwater from Site 1, and receives tidal influences from Bayou Grande. Rubble deposits exist on the south shore of Wetland 16.

The IR site potentially affecting Wetland 16 is Site 1 (Sanitary Landfill), which was used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base (NEESA, 1983).

### **10.5.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-5-1 denotes the Phase IIA Wetland 16 sampling locations.

#### **Sediment**

Twenty-one metals were detected in Wetland 16 sediment samples. Eight metals — arsenic (10.9 ppm), cadmium (8.5 ppm), chromium (78.4 ppm), copper (90.8 ppm), lead (182 ppm), mercury (0.41 ppm), silver (1.8 ppm), and zinc (319 ppm) exceeded sediment benchmark levels at sample location 1603. All Wetland 16 metals exceedances occurred at this sample location. Five pesticides were detected in Wetland 16 sediment samples, including 4,4'-DDT and its metabolites, dieldrin, and alpha-chlordane. No 4,4'-DDT or its metabolites exceeded basewide

levels. Dieldrin exceeded its sediment screening level (0.715 ppb) at location 1603 (4.2 ppb). Aroclor-1254 exceeded its sediment screening level (21.6 ppb) at location 1603 (78 ppb). Seven SVOCs were detected, many of which were high- and low-molecular weight PAHs, and one phthalate ester. Bis(2-ethylhexyl)phthalate exceeded its screening standard (182 ppb) at location 1603 (720 ppb). The VOC methylene chloride, a common laboratory contaminant, was also detected in Wetland 16 sediments.

Table 10-5-1 shows the Wetland 16 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-5-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-5-2. The HQs will be further discussed in the ecological risk section.

### **Surface Water**

Ten metals were detected in Wetland 16 surface water samples. Iron exceeded saltwater surface water criteria at all three sample locations (414 ppb, 816 ppb, and 1,020 ppb at locations 001W001601, 1601, and 1602). Thallium exceeded saltwater surface water criteria (6.3 ppb) at sample locations 1601 (13.9 ppb) and 1602 (14.8 ppb). No pesticides, PCBs, or SVOCs were detected in surface water at Wetland 16. Two VOCs, 1,1-dichloroethane, and chlorobenzene were detected below surface water quality criteria.

Table 10-5-3 shows the Wetland 16 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-5-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-5-4. The HQs will be further discussed in the ecological risk section.



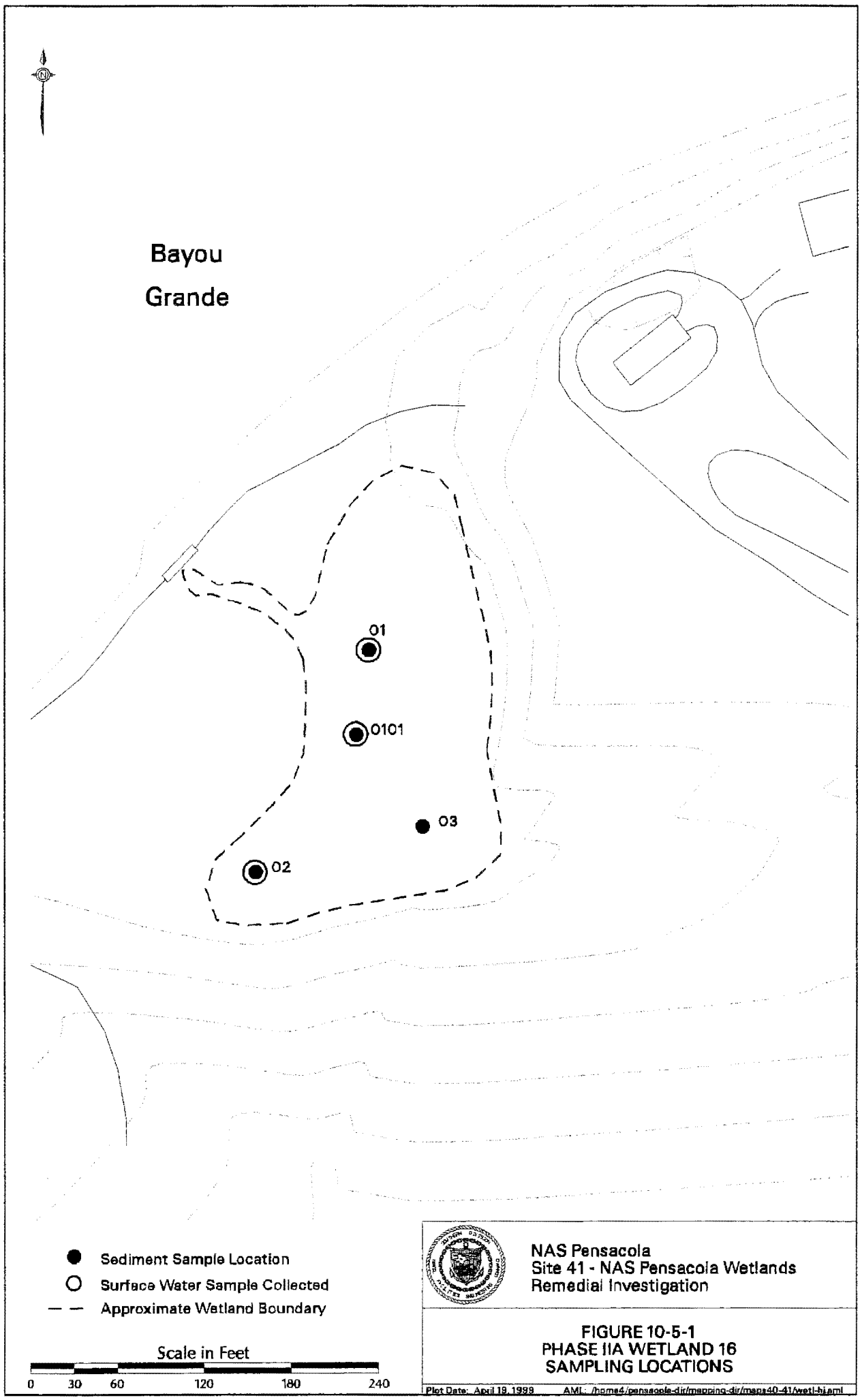


Table 10-5-1  
 Detected Concentrations in Wetland 16 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	4/4	255 - 8880	4123.75
Arsenic (As)	4/4	0.72 - 10.9	3.63
Barium (Ba)	4/4	2.3 - 8.1	4.87
Beryllium (Be)	2/4	0.18 - 0.47	0.33
Cadmium (Cd)	2/4	0.61 - 8.5	4.56
Calcium (Ca)	4/4	53.9 - 2090	781.4
Chromium (Cr)	4/4	1.9 - 78.4	27.43
Cobalt (Co)	4/4	0.7 - 1.7	1.2
Copper (Cu)	3/4	1.4 - 90.8	25.8
Iron (Fe)	4/4	1330 - 39500	12732.5
Lead (Pb)	4/4	2.1 - 182	50.55
Magnesium (Mg)	4/4	109 - 3830	1602.25
Manganese (Mn)	4/4	1.4 - 211	62.73
Mercury (Hg)	1/3	0.41	0.41
Nickel (Ni)	2/4	1.9 - 8.4	5.15
Potassium (K)	3/4	42.9 - 1580	711.64
Selenium (Se)	2/4	0.4 - 0.84	0.62
Silver (Ag)	1/3	1.8	1.8
Sodium (Na)	4/4	480 - 12300	4512.5
Vanadium (V)	4/4	1.2 - 34	11.7
Zinc (Zn)	4/4	2.5 - 319	90.80
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	4/4	.27 - 4.8	1.75
4,4'-DDE	3/4	0.3 - 26	9.8
4,4'-DDT	1/4	2.8	2.8
alpha-Chlordane	1/4	0.47	0.47
Aroclor-1254	3/4	2.1 - 78	30.37
Dieldrin	2/4	0.35 - 4.2	2.28
<b>SVOCs (µg/kg)</b>			
Benzo(b)fluoranthene	1/4	100	100
bis(2-Ethylhexyl)phthalate (BEHP)	3/4	110 - 720	336.67
Butylbenzylphthalate	1/4	31	31
Di-n-butylphthalate	1/4	34	34
Diethylphthalate	1/4	90	90
Fluoranthene	2/4	58 - 100	79
Pyrene	2/4	45 - 110	77.5
<b>VOCs (µg/kg)</b>			
Methylene chloride	1/4	110	110

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-5-2 (1)  
**Wetland 16**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M160100</b>					
4,4'-DDD (UG/KG)		4.8	1.22	3.58	b
4,4'-DDE (UG/KG)		24	2.07	21.93	b
Aroclor-1254 (UG/KG)		103	21.6	81.4	b
Arsenic (MG/KG)		4.7	7.24	2.54	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		103	182	89	a b
<b>041M160101</b>					
4,4'-DDD (UG/KG)		0.27	1.22	0.95	b
4,4'-DDE (UG/KG)		0.3	2.07	0.14	b
Aroclor-1254 (UG/KG)		2.1	21.6	0.10	b
Arsenic (MG/KG)		0.72	7.24	0.10	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		110	182	0.60	b
Chromium (MG/KG)		1.9	52.3	0.04	a b
Copper (MG/KG)		1.1	18.7	0.07	a b
Lead (MG/KG)		2.1	30.2	0.07	a b
Zinc (MG/KG)		2.5	124	0.02	a b
<b>041M160201</b>					
4,4'-DDD (UG/KG)		1.5	1.22	1.23	b
4,4'-DDE (UG/KG)		3.1	2.07	1.50	b
Aroclor-1254 (UG/KG)		11	21.6	0.51	b
Arsenic (MG/KG)		1.5	7.24	0.21	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		180	182	0.98	b
Cadmium (MG/KG)		0.61	0.68	0.90	b
Chromium (MG/KG)		19.1	52.3	0.37	a b
Copper (MG/KG)		5.3	18.7	0.28	a b
Dieldrin (UG/KG)		0.35	0.72	0.49	b
Fluoranthene (UG/KG)		58	113	0.51	b
Lead (MG/KG)		14	30.2	0.46	a b
Nickel (MG/KG)		1.9	15.9	0.12	a b
Pyrene (UG/KG)		45	153	0.29	b
Zinc (MG/KG)		29.5	124	0.24	a b
<b>041M160301</b>					
4,4'-DDD (UG/KG)		4.8	1.22	3.93	b
4,4'-DDE (UG/KG)		26	2.07	12.56	b
4,4'-DDT (UG/KG)		2.8	1.19	2.35	b
alpha-Chlordane (UG/KG)		0.47	1.7	0.28	a
Aroclor-1254 (UG/KG)		78	21.6	3.61	b
Arsenic (MG/KG)		10.9	7.24	1.51	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		720	182	3.98	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SBVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

Table 10-5-2 (2)

**Wetland 16****Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Cadmium (MG/KG)	8.5	0.68	12.50	b
	Chromium (MG/KG)	78.4	52.3	1.50	a b
	Copper (MG/KG)	90.8	18.7	4.86	a b
	Dieldrin (UG/KG)	4.2	0.72	5.83	b
	Fluoranthene (UG/KG)	100	113	0.88	b
	Lead (MG/KG)	182	30.2	6.03	a b
	Mercury (MG/KG)	0.41	0.13	3.15	a b
	Nickel (MG/KG)	8.4	15.9	0.53	a b
	Pyrene (UG/KG)	110	153	0.72	b
	Silver (MG/KG)	1.8	0.73	2.47	b
	Zinc (MG/KG)	319	124	2.57	a b

**Notes:**

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

**Table 10-5-3**  
**Detected Concentrations in Wetland 16 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/3	98.9 - 304	201.45
Barium (Ba)	2/3	30.5 - 31.9	31.2
Calcium (Ca)	3/3	104000 - 145000	121333.33
Iron (Fe)	3/3	414 - 1020	750
Magnesium (Mg)	3/3	294000 - 419000	350666.67
Manganese (Mn)	3/3	50.1 - 56.6	53.9667
Potassium (K)	3/3	98700 - 162000	125233.33
Sodium (Na)	3/3	2410000 - 3820000	2980000
Thallium (Tl)	2/3	13.9 - 14.8	14.35
Zinc (Zn)	2/3	7.1 - 7.4	7.25
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
1,1-Dichloroethane	1/3	2	2
Chlorobenzene	2/3	1	1

*Note:*  
 All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10.5-4 (1)

## Wetland 16

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
001W001601	Saltwater					
	Aluminum	UG/L	98.9	1,500.0	0.06593	b
	Iron	UG/L	414.0	300.0	1.38	b
<b>041W160201</b>						
041W160201	Saltwater					
	Aluminum	UG/L	304.0	1,500.0	0.20267	b
	Iron	UG/L	1,020.0	300.0	3.4	b
	Thallium	UG/L	14.6	6.3	2.34921	a
	Zinc	UG/L	7.1	96.0	0.08255	a/b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1995)

Some of the numbers in the table may vary because of rounding.

### **10.5.3 Fate and Transport**

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data is lacking, many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-5-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-5-4.

#### **Transport Into the Wetland**

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 16 through this pathway:

- Potential storm water runoff and sediment entrainment from Site 1. Additionally, this wetland has a direct connection to Bayou Grande via a small tidal inlet, and will experience back flushing of surface water during high tide and storm surge events.

Sediment contaminants above benchmark levels (see Table 10-5-2) validate this sediment transport pathway, and by inference surface water as well. Additionally, one inorganic exceeded its surface water criteria, further validating the pathway.

Table 10-5-5  
 Calculated Sediment Screening Values for Wetland 16

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppb)		(ppm)	(ppm)	
Arsenic	36 <sup>a</sup>	2.9E+01	105	10.9	NO
Cadmium	9.3 <sup>a, b</sup>	7.5E+01	69.9	8.5	NO
Chromium	50 <sup>a, b</sup>	1.9E+01	95.7	78.4	NO
Lead	5.6 <sup>b</sup>	9E+02	504	182	NO
Mercury	0.025 <sup>a, b</sup>	5.2E+01	0.13	0.41	YES
Silver	0.23 <sup>a, b</sup>	8.3	0.194	1.8	YES
Zinc	86 <sup>a, b</sup>	6.2E+01	534	319	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4 DDE	0.14 <sup>a</sup>	1.03E+05	1.44E+06	26	NO
4,4 DDD	0.025 <sup>a</sup>	2.3E+04	5.75E+04	4.8	NO
Dieldrin	0.0019 <sup>a, b</sup>	4.92E+02	93.5	4.2	NO
Bis(2-ethylhexyl)phthalate	NA	3.48E+05	NA	720	NA

**Notes:**

Kd for organics calculated using foc of 0.023 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class II Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the primary potential source that would directly contribute contamination to Wetland 16 through this pathway is Site 1. Contamination found in groundwater validates this pathway.



## **Transport Within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment transport will occur to the north into Bayou Grande. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

### *Sediment Leaching to Surface Water Pathway*

Four organics — three pesticides and one semivolatile — and seven inorganics exceeded their SSV (see Table 10-5-5), but only two — mercury and silver — exceeded their calculated SSL (see Table 10-5-5). None of these inorganics were detected in the corresponding surface water, thus the potential for their partitioning to surface water is considered low. Iron was the only constituent in surface water above standards, and it is likely attributable to the surface water/groundwater discharge pathway. Because two inorganics were detected in sediment above their SSLs, the pathway is considered valid, but with a low potential for partitioning to surface water.

## **Transport From the Wetland**

Surface water and sediment from Wetland 16 can be expected to move directly into Bayou Grande, with some landward movement during periods of high tide and storm surge events. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

### **10.5.4 Ecological Risk Assessment**

HQs for Wetland 16 sediment samples are presented in Table 10-5-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic (1.51), cadmium (12.50), chromium (1.50), copper (4.86), lead (6.03), mercury (3.15), silver (2.47), and zinc (2.57) at sample location 1603. HQs were above 1 for 4,4'-DDD (3.93), 4,4'-DDE (12.56),

and 4,4'-DDT (2.35), respectively at sample location 1603. HQs were also above 1 for 4,4'-DDD (1.23) and 4,4'-DDE (1.50) at sample location 1602. However, as noted in the Nature and Extent discussion, the concentrations of 4,4'-DDT and its metabolites were below basewide levels. The HQ was greater than 1 for dieldrin (5.83), Aroclor-1254 (3.61), and bis(2-ethylhexyl)phthalate (3.96) at location 1603. Phase IIA surface water results revealed HQs greater than 1 for iron at all three sample locations (1.38, 2.72, and 3.4 at locations 001W001601, 1601, and 1602). Thallium had HQs above 1 at sample locations 1601 (2.21) and 1602 (2.35). HQs greater than 1 indicate a potential for excess risk.

### **Phase IIB/III**

Based on Phase IIA data, Wetland 16 was classified in Group C and sampled in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

### **Conceptual Model**

Estuarine Wetland 16 is fed from the east and the south by groundwater from the area of Site 1 and from the northwest by tidal influences from Bayou Grande. The open water portion of the wetland ranges from about one to five feet deep and has a maximum width of about 200 feet. This wetland supports wading birds, diving birds, fisheries and benthic macroinvertebrates, which are considered the primary habitat functional uses. This wetland is suspected of being impacted by Site 1. Although not as prevalent as some other wetlands, select metals are the primary contaminants of concern. Therefore, directly toxic impacts to benthic macroinvertebrates are expected to be the most significant exposure route. Since benthic exposure is of greatest concern via the sediment, no surface water samples were collected from Wetland 16. The conceptual model for Wetland 16 is shown on Figure 10-5-2.

### **Sampling Location Rationale**

One Phase IIB/III sediment sample was collected at Phase IIA location 16033 for toxicity analysis, sediment chemistry, TOC, grain size, and benthic diversity. This sample was selected because of the relatively high metal concentrations in the sediment. Three composite grab samples for

benthic diversity were collected within 10 feet of this sample location to account for spatial variability.

### **Ecological Risk Evaluation**

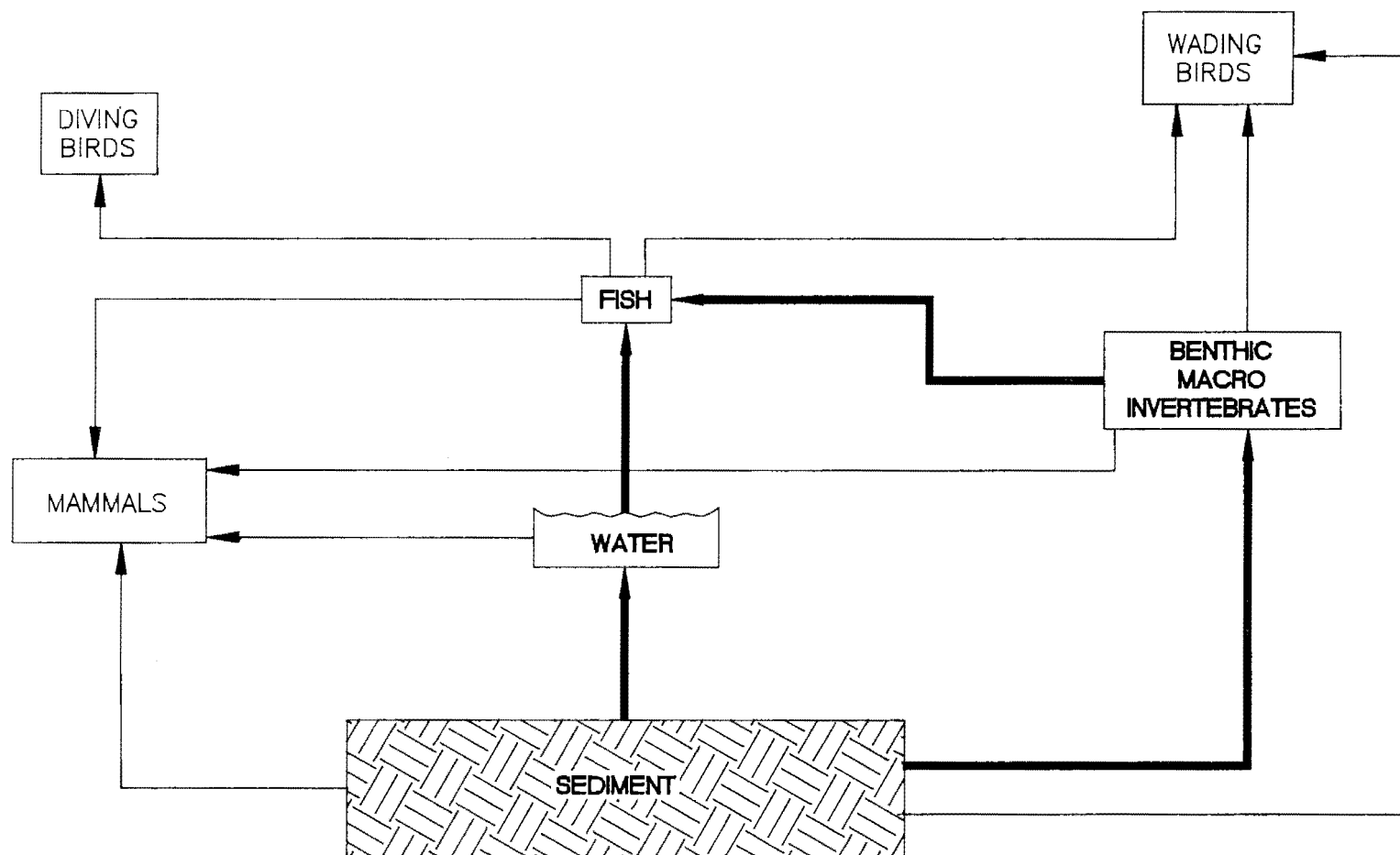
Risk in Wetland 16 was evaluated using two estuarine bioassay organisms with the assessment endpoint: survival and growth of macroinvertebrates associated with the benthic environment. Impacts to fish were not evaluated because the shallow depth of the wetland does not support upper trophic level fish. During Phase IIA, water quality criteria were exceeded for iron only in the two surface water samples collected. An additional sample collected as part of the Site 1 RI also showed iron to exceed its water quality criteria. There is little data regarding the toxic effects of iron to fish species.

### **Survival and Growth of Macroinvertebrates Associated with the Benthic Environment:**

As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach of chemistry, toxicity and community analysis. Results are scored via the decision making triad, and the overall condition of the wetland for this assessment endpoint is determined.

### **Sediment Chemistry**

Table 10-5-6 compares detected Phase IIB/III sediment concentrations to benchmark levels, and lists calculated HQs for each parameter. DDT and its metabolites are also compared to basewide levels (see Section 6). Only the detected parameters with benchmark levels are presented in Table 10-5-6. As shown on Table 10-5-6, sediment HQ values are greater than one for DDT and its metabolites. However, their concentrations are below the basewide levels (see Section 6). Cadmium is the only other detected parameter with an HQ above 1, therefore, a matrix score of “—” for chemistry is applied.



NOTE: BOLD LINES INDICATE  
COMPLETE PATHWAY



SITE 41 RI REPORT  
NAVAL AIR STATION PENSACOLA  
PENSACOLA, FLORIDA

FIGURE 10-5-2  
GROUP C: WETLAND 16  
CONCEPTUAL MODEL

DWG DATE: 03/11/99 DWG NAME: 0036S015

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Table 10-5-6 (1)

**Wetland 16****Phase IIB/III Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M160301</b>					
	4,4'-DDD (UG/KG)	6.9	1.22	5.66	b
	4,4'-DDE (UG/KG)	4.8	2.07	2.32	b
	4,4'-DDT (UG/KG)	16	1.19	13.45	b
	Arsenic (MG/KG)	5.5	7.24	0.76	a b
	Cadmium (MG/KG)	0.91	0.68	1.34	b
	Chromium (MG/KG)	24.6	52.3	0.47	a b
	Copper (MG/KG)	16	18.7	0.86	a b
	Endrin (UG/KG)	1.3	3.3	0.39	a
	Fluoranthene (UG/KG)	32	113	0.28	b
	Lead (MG/KG)	29.4	30.2	0.97	a b
	Mercury (MG/KG)	0.07	0.13	0.54	a b
	Nickel (MG/KG)	4.4	15.9	0.28	a b
	Silver (MG/KG)	0.34	0.73	0.47	b
	Zinc (MG/KG)	68.5	124	0.55	a b

**Notes:**

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

## Sediment Toxicity

Survival results for Wetland 16 sediments were 93% for the *Leptocheirus* test and 100% for the *Neanthes* test, as presented in Table 10-5-7. Weight was also noted to not be significant different from the control in the *Leptocheirus* test. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the amphipod and polychaete tests.

## Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. Location 16-03 was sampled and found to contain a large population of a few polychaetes. *Capitella capitata*, *Mediomastus californiensis*, and *Streblospio benedicti*, are all polychaetes which are found in brackish backwater areas and are considered pollution tolerant. The diversity (1.69) was lower than the diversity detected in other estuarine wetlands. A total of 37 organisms were collected and sorted into five dominant species.

Table 10-5-7  
 Toxicity Results  
 Wetland 16 Sediment

Site	<i>Leptocheirus</i>	<i>Neanthes</i>	Weight (mg)	Triad Matrix Scoring
	% Survival	% Survival		
Control (negative)	98	100	8.5	
Wetland 16 (16-03)	93	100	8.0	—

**Note:**

\* = Statistically significant difference from control population.

Benthic diversity results and application to the triad matrix are presented in Table 10-5-8. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-5-8  
 Benthic Diversity Results  
 Wetland 16 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 16 (16-03)	1.69	1.05	4.72	—

## **Evaluation Summary**

Although detected concentrations in sediment generate an HI greater than 1, a potential for toxic effects to the benthic community is not anticipated because the toxicity results showed no acute or chronic effects for survival or growth. DDT and its metabolites were the greatest contributors to the HQs, and their detected concentrations are below basewide levels. The species diversity tests shows that the sample contained a large number of a few polychaetes.

Table 10-5-9 presents the interpretation of the triad analysis for the Wetland 16 Phase IIB/III sediment samples. Based on the results of the chemistry, toxicity, and diversity data, condition number 2 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

**Table 10-5-9  
Triad Analysis Interpretation  
Wetland 16 Sediment**

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 16	—	—	—	2.

Condition number 2 denotes that Wetland 16 sediments are acceptable and no further action is recommended for sediment for this wetland.

## **10.5.5 Human Health Risk Assessment**

### **10.5.5.1 Samples Included**

#### **Sediment**

041M01601, 041M016201, 041M016301, 041M160101

#### **Surface Water**

041W01601, 041W016201, 041W160101



#### **10.5.5.2 Current and Future Land Use**

This wetland abuts to the NAS Pensacola picnic grounds. A nature trail traverses the north shore of the wetland, following the shoreline of Bayou Grande. The south shore of Wetland 16 is within the Site 1 landfill, and is restricted to trespassers.

#### **10.5.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.5.5.4 Sediment COPCs**

As shown in Table 10-5-10, no sediment COPCs were identified.

#### **10.5.5.5 Surface Water COPCs**

As shown in Table 10-5-11, the following surface water COPC was identified:

- Thallium

#### **10.5.5.6 Risk Characterization**

As shown in Table 10-5-12, thallium is the only contributor to hazard index estimates for the surface water pathway under the adolescent trespasser scenario. The hazard index was estimated to be 0.18. As discussed in Section 8 a COC was considered to be a constituent that contributed to a pathway of concern that exceeded unity (one), as a result, thallium was not considered a COC.

#### **10.5.5.7 Remedial Goal Options**

No COCs were identified for Wetland 16, and as a result, no RGOs were calculated.

**TABLE 10-5-10  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 16 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection	
72548	4,4'-DDD	0.2700	J	4.80	J	UG/KG	041M160101	4 / 4	NAV	1.75	4.8	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	0.3000	J	26.0000	J	UG/KG	041M160301	3 / 4	6.10 - 6.10	9.80	26	N/A	65000	1900	C	N/A	NO	BSL
50293	4,4'-DDT	2.8000	J	2.8000	J	UG/KG	041M160301	1 / 4	0.21 - 6.10	2.80	2.8	N/A	65000	1900	C	N/A	NO	BSL
5103719	alpha-Chlordane	0.4700	J	0.4700	J	UG/KG	041M160301	1 / 4	0.10 - 3.20	0.47	0.47	N/A	63000	1800	C	N/A	NO	BSL
7429905	Aluminum (Al)	255.0000		8880.00		MG/KG	041M160201	5 / 5	NAV	3753.00	8880	N/A	320000	7800	N	N/A	NO	BSL
7440360	Antimony (Sb)	15.1000	J	15.1000	J	MG/KG	041M160301	1 / 5	0.23 - 11.00	15.10	15.1	N/A	130	3.1	N	N/A	NO	BSL
11097691	Aroclor-1254	2.1000	J	78.0000	J	UG/KG	041M160101	3 / 4	61.00 - 61.00	30.37	78	N/A	11000	160	N	N/A	NO	BSL
7440382	Arsenic (As)	0.7200		10.9000		MG/KG	041M160301	4 / 5	0.47 - 0.47	3.63	10.9	N/A	15	0.43	C	N/A	NO	BSL
7440393	Barium (Ba)	2.3000	J	8.1000	J	MG/KG	041M160301	3 / 5	0.69 - 8.40	4.87	8.1	N/A	22000	550	N	N/A	NO	BSL
205992	Benzo(b)fluoranthene	100.0000	J	100.0000	J	UG/KG	041M160301	1 / 4	40.00 - 620.00	100.00	100	N/A	30000	880	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.1800	J	0.4700	J	MG/KG	041M160301	2 / 5	0.07 - 0.40	0.33	0.47	N/A	630	16	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate	110.0000	J	720.0000	J	UG/KG	041M160201	3 / 4	620.00 - 620.00	336.67	720	N/A	1600000	46000	C	N/A	NO	BSL
7440702	Butylbenzylphthalate	31.0000	J	31.0000	J	UG/KG	041M160101	1 / 4	620.00 - 1700.00	31.00	31	N/A	63000000	1600000	N	N/A	NO	BSL
7440439	Cadmium (Cd)	0.6100		8.5000		MG/KG	041M160201	2 / 5	0.19 - 1.20	4.56	8.5	N/A	320	7.8	N	N/A	NO	BSL
7440702	Calcium (Ca)	53.9000	J	2090.0000		MG/KG	041M160101	4 / 5	54.40 - 54.40	781.48	2090	N/A	N/A	N/A	N/A	NO	EN	
7440473	Chromium (Cr)	1.9000		78.40		MG/KG	041M160101	5 / 5	NAV	26.02	78.4	N/A	1600	23	N	N/A	NO	BSL
7440484	Cobalt (Co)	0.7000	J	1.7000	J	MG/KG	041M160301	2 / 5	0.19 - 1.90	1.20	1.70	N/A	19000	470	N	N/A	NO	BSL
7440508	Copper (Cu)	1.4000	J	90.8000		MG/KG	041M160201	4 / 5	3.90 - 3.90	25.80	90.8	N/A	13000	310	N	N/A	NO	BSL
60571	Dieldrin	0.3500	J	4.2000	J	UG/KG	041M160201	2 / 4	0.21 - 6.10	2.28	4.2	N/A	1400	40	C	N/A	NO	BSL
84662	Diethylphthalate	90.0000	J	90.0000	J	UG/KG	041M160201	1 / 4	400.00 - 1700.00	90.00	90	N/A	250000000	6300000	N	N/A	NO	BSL
84742	Di-n-butylphthalate	34.0000	J	34.0000	J	UG/KG	041M160201	1 / 4	400.00 - 1700.00	34.00	34	N/A	32000000	780000	N	N/A	NO	BSL
206440	Fluoranthene	58.0000	J	100.0000	J	UG/KG	041M160301	2 / 4	40.00 - 620.00	79.00	100	N/A	13000000	310000	N	N/A	NO	BSL
7439896	Iron (Fe)	1330.0000		39500.00		MG/KG	001M001601	5 / 5	NAV	11242.00	39500	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	2.1000		182.0000		MG/KG	041M160301	4 / 5	11.00 - 11.00	50.55	182	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	109.0000	J	3830.0000		MG/KG	041M160301	4 / 5	12.60 - 12.60	1602.25	3830	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	1.4000		211.00		MG/KG	041M160201	5 / 5	NAV	54.32	211	N/A	15000	1100	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.4100	J	0.4100	J	MG/KG	041M160301	1 / 5	0.05 - 0.18	0.41	0.41	N/A	73	2.3	N	N/A	NO	BSL
75092	Methylene chloride	110.0000		110.0000		UG/KG	041M160301	1 / 4	12.00 - 55.00	110.00	110	N/A	2900000	85000	C	N/A	NO	BSL
7440020	Nickel (Ni)	1.9000	J	8.4000	J	MG/KG	041M160301	3 / 5	0.78 - 14.50	4.30	8.4	N/A	6300	160	N	N/A	NO	BSL
7440097	Potassium (K)	42.9000	J	1580.0000		MG/KG	041M160101	4 / 5	929.00 - 929.00	705.48	1580	N/A	N/A	N/A	N/A	NO	EN	
129000	Pyrene	45.0000	J	110.0000	J	UG/KG	041M160201	2 / 4	40.00 - 620.00	77.50	110	N/A	9500000	230000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.4000	J	0.8400	J	MG/KG	041M160301	2 / 5	0.19 - 1.40	0.62	0.84	N/A	1600	39	N	N/A	NO	BSL
7440224	Silver (Ag)	1.8000	J	1.8000	J	MG/KG	041M160301	1 / 5	0.26 - 1.50	1.80	1.8	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	480.0000		12300.0000		MG/KG	001M001601	4 / 5	2410.00 - 2410.00	4512.50	12300	N/A	N/A	N/A	N/A	NO	EN	
7440622	Vanadium (V)	1.2000	J	34.00		MG/KG	041M160101	5 / 5	NAV	11.70	34	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	2.5000		319.00		MG/KG	001M001601	5 / 5	NAV	75.46	319	N/A	95000	2300	N	N/A	NO	BSL

- (1) Minimum/maximum detected concentration  
(2) Maximum concentration used as screening value.  
(3) Background values were not developed for this media.  
(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.  
(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).  
(6) Rationale Codes  
Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable  
NAV = Not Available  
COPC = Chemical of Potential Concern  
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
OSWER = Office of Solid Waste and Emergency Response  
J = Estimated Value  
C = Carcinogenic  
N = Noncarcinogenic

TABLE 10-5-11  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 18 Surface Water

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables. (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-5-12  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 16  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Thallium	0.0148	MG/L	N/A	M	6.09E-06	mg/kg-day	7.00E-05	mg/kg-day	0.087
Dermal	Thallium	0.0148	MG/L		M	1.27E-06	mg/kg-day	1.40E-05	mg/kg-day	0.091
Total Hazard Index										0.18

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

#### **10.5.6 Conclusions and Recommendations**

Wetland 16 is on the northeastern side of Site 1, along the shore of Bayou Grande, and adjacent to the NAS Pensacola picnic ground.

The ecological risk assessment for Wetland 16 measured assessment endpoints for benthic macroinvertebrate community diversity. Benthic community toxicity results showed no chronic effects for survival and emergence, and diversity was satisfactory. Further, decision making triad results for Phase IIB/III sediment analytical results revealed an overall condition number 2 for sediment at Wetland 16, indicating that sediment is acceptable at this wetland. Though no further endpoints were considered at Wetland 16, this wetland is a Group C Wetland, and can be compared to Wetland 18. Ecological risk in Wetland 18 was evaluated with respect to piscivorous bird health and reproduction; survival, growth, and reproduction of macroinvertebrates associated with the benthic environment; and protection of fish viability. Decision making triad results for Wetland 18 Phase IIB/III sediment and surface water analytical results (both condition number 3) indicated that Wetland 18 sediment and surface water were acceptable and no further action was recommended for either media at Wetland 18. The surface water triad results for Wetland 18 should also apply to Wetland 16. Ecological risk for sediment and surface water at Wetland 16 should therefore be considered acceptable.

The HHRA identified no sediment or fish tissue COPCs at Wetland 16. Thallium was identified as a surface water COPC at this wetland; however, since the hazard estimate for thallium was 0.18, it was not considered to be a COC. Since there were no COCs at Wetland 16, no RGOs were calculated.

Because of the lack of excess ecological risk, and the lack of excess human health risk at Wetland 16, no further action is recommended for this wetland.

## **10.6 Wetland 18**

### **10.6.1 Site Description**

Wetland 18 is on the west side of the Site 1 area, along the eastern shore of Redoubt Bayou, which empties to the north into Bayou Grande. Parsons and Pruitt (USEPA, 1991) divided this wetland into two parts, 18A and 18B. The upstream end is Wetland 18A, classified as a palustrine emergent system, and the downstream end is Wetland 18B, classified as an estuarine emergent system. Wetlands 18A and 18B are bordered by Redoubt Bayou to the west, and Site 1 to the east. Wetland 18A is fed by groundwater seep originating from Site 1, which becomes a small stream approximately two-feet wide and one-foot deep. This stream flows through Wetland 18A, which contains woods on either bank. The stream widens as Wetland 18A transitions to Wetland 18B, becoming an emergent marsh containing saw grass (*Cladium jamaicense*) and black needle rush (*Juncus roemerianus*). Wetland 18B has a maximum width of about 50 feet, is 1 foot or less in depth, and is tidally influenced from Redoubt Bayou. A shallow sheet flow of freshwater from Wetland 18A flows across Wetland 18B before discharging into Redoubt Bayou.

The IR site potentially affecting Wetland 18 is Site 1 (Sanitary Landfill), used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base (NEESA, 1983).

### **10.6.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-6-1 denotes the Phase IIA Wetland 18 sampling locations.

### **Sediment**

Sixteen metals plus cyanide were detected in Wetland 18 sediment samples. Arsenic exceeded the sediment benchmark level at three sample locations (8.40 ppm, 31.4 ppm, and 83.8 ppm at

locations 1801, 18A2, and 18B1). Lead exceeded its sediment benchmark level at all five sample locations (63.3 ppm, 70.1 ppm, 45.4 ppm, 66 ppm, and 111 ppm at locations 1801, 18A1, 18A2, 18A3, and 18B1). Copper and chromium each exceeded criteria at 18A1 (22.6 ppm) and 18B1 (66.2 ppm) respectively. Nine pesticides were detected in Wetland 18 sediment samples, including 4,4'-DDT and its metabolites, aldrin, beta-BHC, endrin, endrin ketone, and alpha/gamma-chlordane. 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT exceeded basewide levels along the upper and middle reaches of Wetland 18A. All three compounds exceeded basewide levels at location 18A1 (930 ppb, 270 ppb, and 1,200 ppb). 4,4'-DDD and 4,4'-DDE exceeded basewide levels at location 1801 (150 ppb for both compounds), while 4,4'-DDE and 4,4'-DDT exceeded basewide levels at location 18A2 (57 ppb and 310 ppb). 4,4'-DDD and 4,4'-DDT exceeded basewide levels at location 18B1 (280 ppb and 1,800 ppb). Endrin (13 ppb), alpha-chlordane (12 ppb), and gamma-chlordane (9.5 ppb) exceeded sediment benchmark levels at sample location 1801. Endrin ketone (6.5 ppb), and alpha-chlordane (4.8 ppb) also exceeded sediment benchmark levels at location 18A2. No PCBs were detected in Wetland 18 sediment samples. Four SVOCs were detected at Wetland 18, including 1,4-dichlorobenzene, 4-methylphenol, di-n-butylphthalate, and naphthalene. The single naphthalene detection at sample location 18A2 (300 ppb) exceeded its benchmark level. Six VOCs were detected in Wetland 18 sediment samples, including 2-butanone, acetone, benzene, chlorobenzene, methylene chloride, and toluene. Acetone and methylene chloride are common laboratory contaminants.

Table 10-6-1 shows the Wetland 18 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-6-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-6-2. The HQs will be further discussed in the ecological risk section.

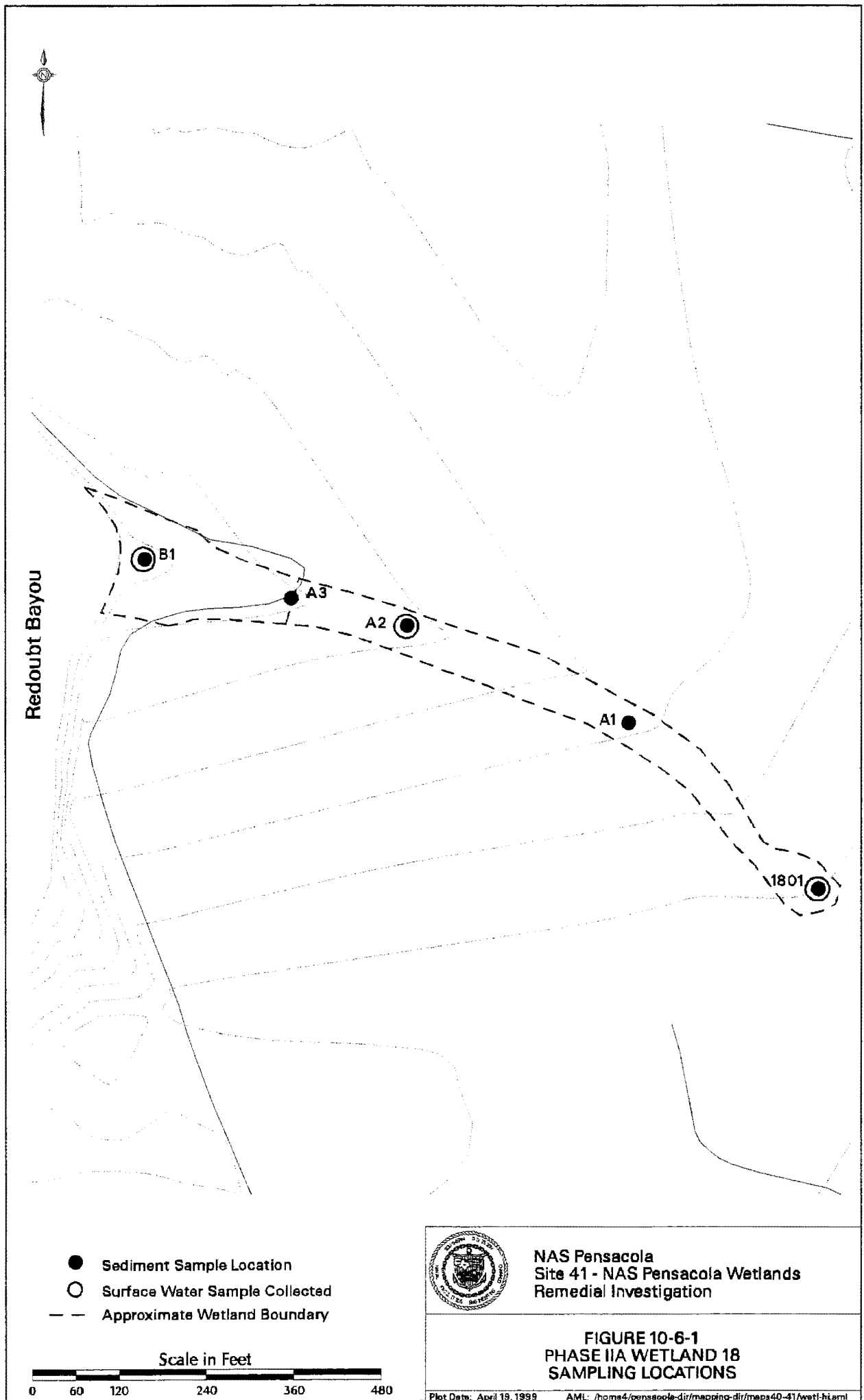




Table 10-6-1  
 Detected Concentrations in Wetland 18 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/kg}</math>)</b>			
Aluminum (Al)	5/5	1550 - 11100	6606
Arsenic (As)	5/5	2.9 - 83.8	25.8
Barium (Ba)	5/5	10.9 - 35.9	21.78
Beryllium (Be)	1/5	0.73	0.73
Calcium (Ca)	5/5	228 - 6840	3651
Chromium (Cr)	4/5	5.8 - 66.2	21.8
Copper (Cu)	4/5	5.2 - 22.6	14.3
Cyanide (CN)	1/5	8.8	8.8
Iron (Fe)	5/5	805 - 128000	40681
Lead (Pb)	5/5	45.4 - 111	71.16
Magnesium (Mg)	5/5	206 - 3420	1395.4
Manganese (Mn)	5/5	15.3 - 105	55.04
Potassium (K)	4/5	151 - 846	393.25
Selenium (Se)	3/5	2.2 - 3.8	2.97
Sodium (Na)	5/5	153 - 3300	1002.4
Vanadium (V)	4/5	7.3 - 50.9	18.85
Zinc (Zn)	5/5	6.7 - 49.3	19.24
<b>Pesticides and PCBs (<math>\mu\text{g/kg}</math>)</b>			
4,4'-DDD	5/5	16 - 930	285
4,4'-DDE	4/5	14 - 270	122.75
4,4'-DDT	4/5	1.9 - 1800	827.98
Aldrin	1/5	3.7	3.7
alpha-Chlordane	2/5	4.8 - 12	8.4
beta-BHC	1/5	1.3	1.3
Endrin ketone	1/5	6.5	6.5
Endrin	1/5	13	13
gamma-Chlordane	1/5	9.5	9.5
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
1,4-Dichlorobenzene	1/5	1100	1100
4-Methylphenol (p-Cresol)	2/5	170 - 330	250
Di-n-butylphthalate	3/5	160 - 430	253.33
Naphthalene	1/5	300	300
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Butanone (MEK)	2/4	98 - 120	109
Acetone	3/4	440 - 750	556.67
Benzene	2/4	34 - 50	42
Chlorobenzene	2/4	46 - 430	238
Methylene chloride	1/4	750	750
Toluene	2/4	85 - 220	152.5

**Notes:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

**Table 10-6-2 (1)**  
**Wetland 18**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>001M001801</b>					
	4,4'-DDD (UG/KG)	150	1.22	122.95	b
	4,4'-DDE (UG/KG)	150	2.07	72.46	b
	alpha-Chlordane (UG/KG)	12	1.7	7.06	a
	Arsenic (MG/KG)	8.4	7.24	1.18	a b
	Endrin (UG/KG)	13	3.3	3.94	a
	gamma-Chlordane (UG/KG)	9.5	1.7	5.59	a
	Lead (MG/KG)	60.3	30.2	2.10	a b
	Zinc (MG/KG)	17.1	124	0.14	a b
<b>041M18A101</b>					
	4,4'-DDD (UG/KG)	830	1.22	762.30	b
	4,4'-DDE (UG/KG)	270	2.07	130.43	b
	4,4'-DDT (UG/KG)	1200	1.19	1008.40	b
	Arsenic (MG/KG)	2.9	7.24	0.40	a b
	Chromium (MG/KG)	5.8	52.3	0.11	a b
	Copper (MG/KG)	22.6	18.7	1.21	a b
	Lead (MG/KG)	70.1	30.2	2.32	a b
	Zinc (MG/KG)	6.7	124	0.05	a b
<b>041M18A201</b>					
	4,4'-DDD (UG/KG)	49	1.22	40.16	b
	4,4'-DDE (UG/KG)	57	2.07	27.54	b
	4,4'-DDT (UG/KG)	310	1.19	260.50	b
	alpha-Chlordane (UG/KG)	4.8	1.7	2.82	a
	Arsenic (MG/KG)	31.4	7.24	4.34	a b
	Chromium (MG/KG)	8.9	52.3	0.17	a b
	Copper (MG/KG)	5.2	18.7	0.28	a b
	Endrin ketone (UG/KG)	6.5	3.3	1.97	a
	Lead (MG/KG)	45.4	30.2	1.50	a b
	Naphthalene (UG/KG)	300	34.6	8.67	b
	Zinc (MG/KG)	10.4	124	0.08	a b
<b>041M18A301</b>					
	4,4'-DDD (UG/KG)	18	1.22	14.74	b
	4,4'-DDE (UG/KG)	14	2.07	6.76	b
	4,4'-DDT (UG/KG)	1.6	1.19	1.30	a b
	Arsenic (MG/KG)	3.6	7.24	0.50	a b
	Chromium (MG/KG)	4.1	52.3	0.08	a b
	Copper (MG/KG)	10.4	18.7	0.56	a b
	Endrin ketone (UG/KG)	1.1	3.3	0.33	a

**Notes:**  
(a) USEPA Screening Concentration for Sediment - EPA SSVs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding

Table 10-6-2 (2)  
**Wetland 18**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M18B101</b>					
	4,4'-DDD (UG/KG)	280	1.22	229.51	b
	4,4'-DDT (UG/KG)	1800	1.19	1512.61	b
	Arsenic (MG/KG)	83.8	7.24	11.57	a b
	Chromium (MG/KG)	66.2	52.3	1.27	a b
	Copper (MG/KG)	17.9	18.7	0.96	a b
	Lead (MG/KG)	111	30.2	3.68	a b
	Zinc (MG/KG)	49.3	124	0.40	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

## **Surface Water**

Surface water samples were collected at locations 001W0018, 18A1, and 18B1. Twelve metals were detected in Wetland 18 surface water samples. Aluminum (1,220 ppb), arsenic (68.3 ppb), chromium (15.6 ppb), iron (122,000 ppb) and lead (12.2 ppb) exceeded freshwater surface water screening criteria (87 ppb, 50 ppb, 11 ppb, 1,000 ppb and 1.71 ppb, respectively) at location 18A2. Aluminum (237 ppb) also exceeded its freshwater criteria at 001W0018. Iron (10,900 ppb) exceeded saltwater surface water criteria (300 ppb) at location 18B1. No pesticides or PCBs were detected in surface water. One SVOC, 1,4-dichlorobenzene, and two VOCs, benzene, and chlorobenzene, were each detected at locations 18A2 and 18B1 below the respective freshwater and saltwater quality criteria for these parameters.

Table 10-6-3 shows the Wetland 18 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-6-4 compares detected concentrations at each sample location to surface water quality criteria, and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-6-4. The HQs will be further discussed in the ecological risk section.

### **10.6.3 Fate and Transport**

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data is lacking, many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-6-5 presents those contaminants detected in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-6-4.

**Table 10-6-3**  
**Detected Concentrations in Wetland 18 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (µg/L)</b>			
Aluminum (Al)	3/3	119 - 1220	525.33
Arsenic (As)	1/3	68.3	68.3
Barium (Ba)	1/3	26.2	26.2
Calcium (Ca)	3/3	3060 - 9420	6746.67
Chromium (Cr)	1/3	15.6	15.6
Iron (Fe)	3/3	848 - 122000	44582.67
Lead (Pb)	1/3	12.2	12.2
Magnesium (Mg)	3/3	1110 - 7280	3413.33
Manganese (Mn)	3/3	47.6 - 144	100.53
Potassium (K)	3/3	901 - 3600	2147
Sodium (Na)	3/3	5340 - 48300	19933.33
Vanadium (V)	1/3	10	10
<b>SVOCs (µg/L)</b>			
1,4-Dichlorobenzene	2/3	1 - 2	1.5
<b>VOCs (µg/L)</b>			
Benzene	2/3	1 - 5	3
Chlorobenzene	2/3	5 - 14	9.5

*Note:*

All results are in micrograms per liter (µg/L) or parts per billion (ppb).

## Transport Into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analyses, the following sources can contribute contamination to Wetland 18 through this pathway:

- Potential storm water runoff and sediment entrainment from Site 1. During high tides and storm surges, surface water and sediment from Bayou Redoubt may enter the wetland.

Sediment contaminants above benchmark levels (see Table 10-6-5) validate this sediment transport pathway, and by inference surface water as well. Additionally, arsenic, iron, and lead were present in surface water above standards, further validating the pathway.

Table 10-6-4 (1)

## Wetland 18

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>001W001801 Freshwater</b>						
Aluminum		UG/L	237.0	87.0	2.72414	a
Iron		UG/L	848.0	1,000.0	0.848	a b
<b>041W18B101 Saltwater</b>						
1,4-Dichlorobenzene		UG/L	1.0	19.0	0.05026	a
Aluminum		UG/L	119.0	1,500.0	0.07933	b
Benzene		UG/L	1.0	71.28	0.01403	b
Iron		UG/L	10,900.0	300.0	36.33333	b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding

Table 10-6-5  
 Calculated Sediment Screening Values for Wetland 18

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganic</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Arsenic	50 <sup>b</sup>	2.9E+01	145.67	83.8	NO
Chromium	11 <sup>a, b</sup>	1.9E+01	21.04	66.2	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	335.5	22.6	NO
Lead	1.71 <sup>a, b</sup>	9E+02	153.92	111	NO
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	10.5 <sup>a</sup>	8.8E+05	1.05E+08	270	NO
4,4 DDD	0.0064 <sup>a</sup>	1.97E+05	1.26E+05	930	NO
4,4 DDT	0.001 <sup>a, b</sup>	5.18E+05	5.18E+04	1800	NO
Alpha Chlordane	0.004 <sup>a, b</sup>	9.00E+02	3.6E+02	0.70	NO
Endrin	0.0023 <sup>a, b</sup>	2.42E+03	5.56E+02	13	NO
Napthalene	62 <sup>a</sup>	3.94E+02	2.44E+06	300	NO

**Notes:**

Kd for organics calculated using foc of 0.197 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 18 through this pathway:

- Discharge from Site 1. Contamination found in Site 1 groundwater validates this pathway.

## **Transport Within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of wetland, along with landform analysis, indicates that surface water and sediment movement is towards Bayou Redoubt, and from there out towards Bayou Grande. Therefore, both sediment and surface water contamination can be expected to remain mobile.

### *Sediment Leaching to Surface Water Pathway*

Four inorganics, five pesticides, and one semivolatile (see Table 10-6-5) exceeded their respective SSV, but only one — chromium — exceeded its calculated SSL. The presence of arsenic and lead in surface water may be attributable to the sediment hosted in the wetland: chromium above its SSL certainly indicates that the sediment can leach this parameter to surface water at levels above standards. Iron in surface water may be related to groundwater discharge from Site 1, which has been shown to have high levels of iron. This pathway is considered valid and those contaminants above SSLs can be expected to partition to surface water at levels above standards.

## **Transport From the Wetland**

Surface water and sediment can be expected to move from the wetland into the Bayou Redoubt and Bayou Grande systems, with some back flushing into the wetland to be expected during high tides and storm surges.

### **10.6.4 Ecological Risk Assessment**

HQs for Wetland 18 sediment samples are presented in Table 10-6-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic at three sample locations (1.16, 4.34, and 11.57 at locations 1801, 18A2, and 18B1). HQs were greater than 1 for lead at all five sample locations (2.10, 2.32, 1.50, 2.19, and 3.68 at locations 1801, 18A1, 18A2, 18A3, and 18B1). Copper and chromium each had HQs greater than 1 at 18A1 (1.21) and 18B1 (1.27) respectively. 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT each had HQs above 1 at locations 18A1 (762.30, 130.43, and 1,008.40), 18A2 (40.16, 27.54, and



260.50), and 18A3 (13.11, 6.76, and 1.60). 4,4'-DDD and 4,4'-DDE also had HQs greater than 1 at location 1801 (122.95 and 72.46), while 4,4'-DDD and 4,4'-DDT had HQs above 1 at location 18B1 (229.51 and 1,512.61). Endrin (3.94), alpha-chlordane (7.06), and gamma-chlordane (5.59) had HQs greater than 1 at sample location 1801. Endrin ketone (1.97), and alpha-chlordane (2.82) also had HQs above 1 at location 18A2. The single naphthalene detection at sample location 18A2 also had a HQ above 1 (8.67). Phase IIA surface water results revealed HQs greater than 1 for aluminum (14.02), arsenic (1.37), chromium (1.42), iron (122.0) and lead (7.13) at location 18A2. Aluminum also had a HQ above 1 (2.72) at location 001W001801, while iron had a HQ above 1 (36.33) at location 18B1. HQs greater than 1 indicate a potential for excess risk; surface water iron was the greatest contributor of risk for this wetland.

### **Phase IIB/III**

Based on Phase IIA data, Wetland 18 was classified in Group C and sampled in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

### **Conceptual Model**

Wetland 18A begins as a groundwater seep that widens to become estuarine as it transitions to Wetland 18B. The open water portion of Wetland 18A is no deeper than one foot and has a maximum width of about 2 feet. Wetland 18B ranges from about 0 to 1 foot deep and has a maximum width of about 50 feet. Wetland 18 is surrounded by vegetation and is bordered by Site 1 to the east. This wetland supports fisheries, wading birds, benthic macroinvertebrates, and mammals, which are considered the primary habitat functional users. The relative abundance of vegetation in the area could serve as a source of habitat and cover for several species. Fish species and benthic macroinvertebrates have been observed in the extreme lower end of this wetland near Bayou Grande. Metals and pesticides are the primary contaminants of concern. Contaminant effects may occur either through direct exposure or bioaccumulative impacts. Therefore, impacts to wading birds, fish, benthic macroinvertebrates, and mammals are considered the most significant exposure routes. Because of the relatively large number of fish collected in this

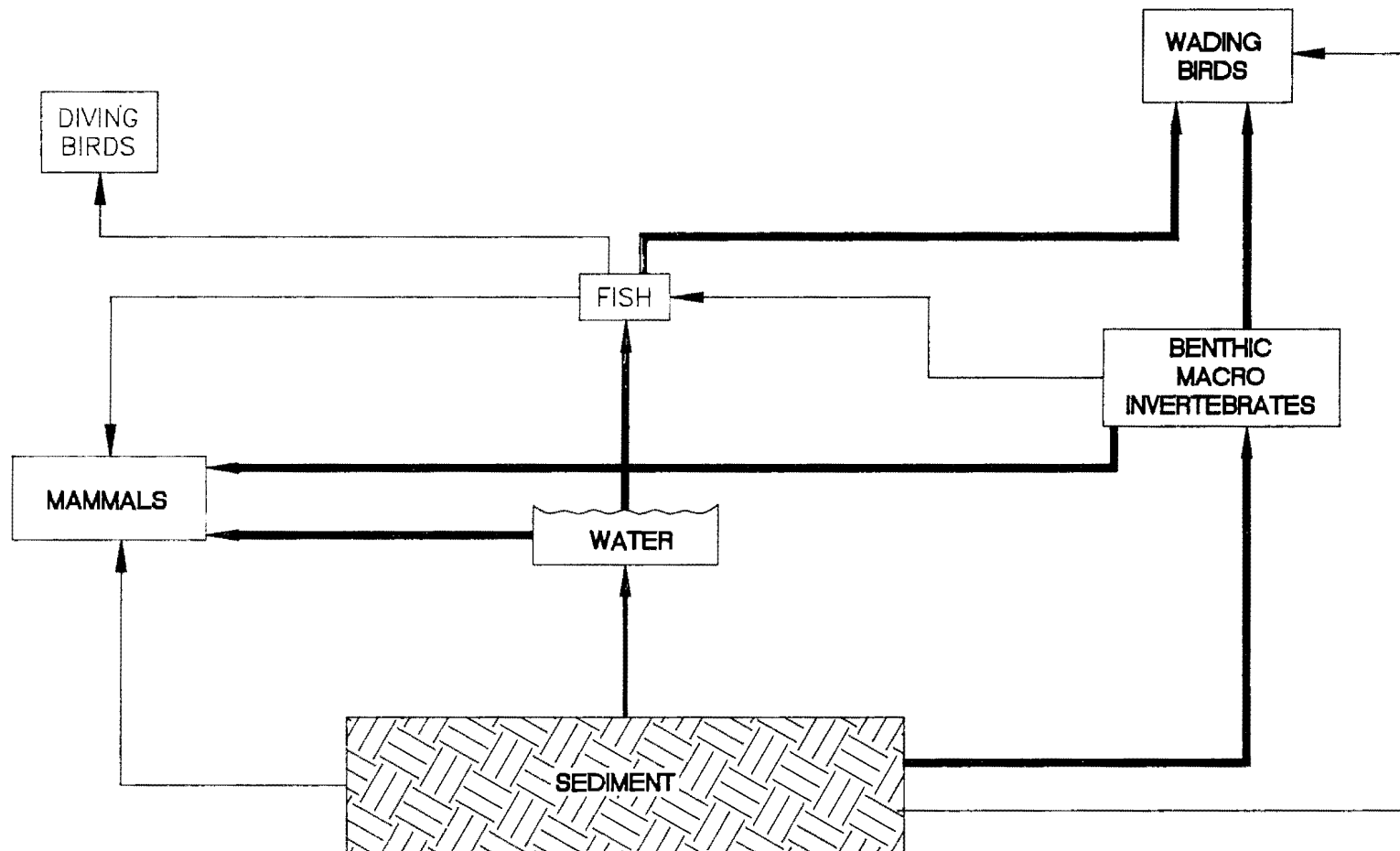
wetland during Phase IIB/III over what was expected, fish were considered a more likely exposure route to piscivorous birds than via mammals. Because the most likely exposure route was considered via the food chain, surface water samples were not collected during Phase IIB/III. The conceptual model for Wetland 18 is shown on Figure 10-6-2.

### Sampling Location Rationale

One Phase IIB/III sediment sample was collected at location 18B1 for toxicity analysis, sediment chemistry, TOC, grain size, benthic diversity, and tissue concentration (Figure 10-6-2). This sample location was selected because of the elevated Phase IIA pesticide concentrations in sediment which were considered representative of the elevated concentrations in the remainder of the wetland. In addition, this sample was located where Wetland 18 drains into Bayou Grande and had the greatest exposure to potential receptor species. Three composite grab samples for benthic diversity were collected within 10 feet of this sample location to account for spatial variability. Native foraging fish were also collected in the general area around Wetland 18B, as close to sample location B1 as possible. Phase IIB/III sampling locations and their associated sediment hazard indices, and Shannon-Weiner Diversity Indices are shown on Figure 10-6-3. The number and lengths of the fish collected at Wetland 18 and the reference Wetland 33 are presented in Table 10-6-6.

Table 10-6-6  
Fish Species Collected from Wetland 18 and Reference Wetlands

Sample Location	Species	Number Collected	Length Range (millimeters)
18B-1	Killifish ( <i>Fundulus grandis</i> )	12	74-117
33-01	Pinfish ( <i>Lagodon rhomboides</i> )	7	55-71
33-02	Pinfish ( <i>Lagodon rhomboides</i> )	25	54-85



NOTE: BOLD LINES INDICATE  
COMPLETE PATHWAY

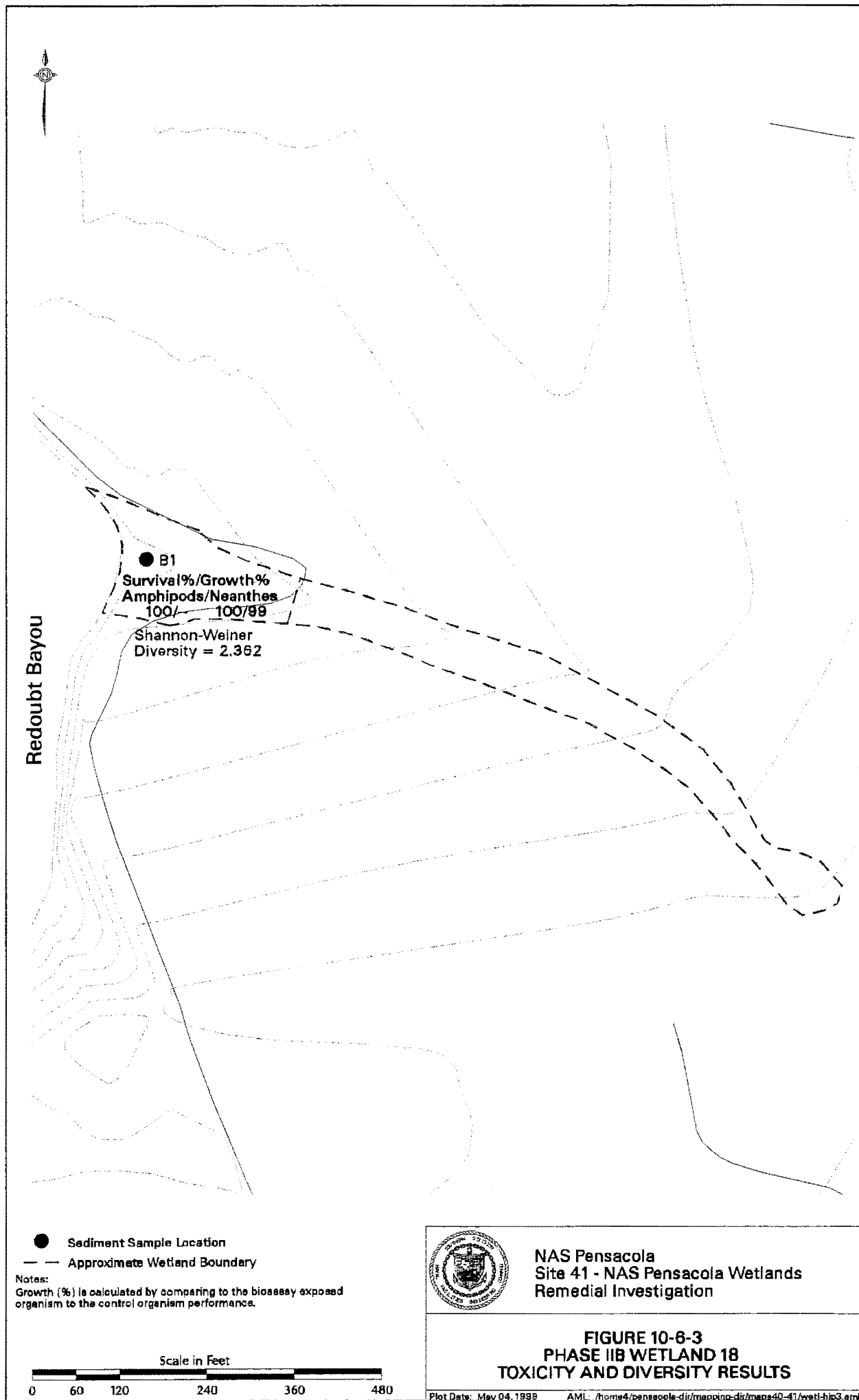


SITE 41 RI REPORT  
NAVAL AIR STATION PENSACOLA  
PENSACOLA, FLORIDA

FIGURE 10-6-2  
GROUP C: WETLAND 18  
CONCEPTUAL MODEL

DWG DATE: 03/11/99 DWG NAME: 0036S016

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## Ecological Risk Evaluation

Risk in Wetland 18 was evaluated with respect to three assessment endpoints: 1) piscivorous bird health and reproduction, 2) survival, growth, and reproduction of macroinvertebrates associated with the benthic environment, and 3) protection of fish viability.

### Piscivorous Bird Health and Reproduction:

The results of this model, as shown in Table 10-6-7, estimate excess risk posed by total DDT and PCBs in fish tissue collected at 18-BO1. Although mercury bioaccumulates, mercury was not detected in Wetland 18 sediment, therefore it was not included in this model. HQs estimated for heron exposure to total DDT in fish tissues from this sampling location are: 7.67 (SFF=1), 3.67 (SFF=0.49, based on the feeding territory in the fall) and 0.13 (SFF=0.02, based on the feeding territory in the winter). HQs for heron exposure to total PCBs in fish tissue were less than 1 for all SFFs.

Considering feeding territory in the model provides a more realistic exposure estimate for the heron. Using an SFF of 1 serves as a reference since it assumes that the heron spends 100% of its time feeding in Wetland 18B.

Table 10-6-7  
 Great Blue Heron HQ Calculations  
 Wetland 18B

SFF Value	Location	Parameter	Tissue Concentration <sup>1</sup> (mg/kg)	Sediment Concentration <sup>2</sup> (mg/kg)	PDE <sup>3</sup> (mg/kg-day)	NOAEL <sup>4</sup> (mg/kg-day)	LOAEL (mg/kg-day)	HQ <sup>5</sup>
1	18B-01	total DDT	0.129	0.152	0.023	0.003	0.028	7.67
0.02 - 0.49	18B-01	total DDT	0.129	0.152	0.0004 - 0.011	0.003	0.028	0.13 - 3.67
1	18B-01	total PCB	0.087	ND	0.015	0.003	1.8	0.83
0.02 - 0.49	18B-01	total PCB	0.087	ND	0.0003 - 0.008	0.003	1.8	0.0017 - 0.044

**Notes:**

- 1 = Whole body killifish or pinfish (wet weight).
- 2 = Samples from top 5 cm of sediment (wet weight).
- 3 = Potential Dietary Exposure: revised from model in SAP (E/A&H, 1997).
- 4 = Effects Levels in Sample *et al.*, 1996.
- 5 = Hazard Quotient = (PDE)÷(NOAEL).
- ND = Not detected.
- NOAEL = No-observed-adverse-effects-level.
- LOAEL = Lowest-observed-adverse-effects-level.

### **Survival and Growth of Macroinvertebrates Associated with the Benthic Environment:**

As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach for chemistry, toxicity, and diversity analysis. Results are scored via the decision making triad, and the overall condition of the wetland for this assessment endpoint is determined.

### **Sediment Chemistry**

Table 10-6-8 compares detected Phase IIB/III sediment concentrations to benchmark levels, and lists calculated HQs for each parameter. DDT and its metabolites are also compared to basewide levels (see Section 6). Only the detected parameters with benchmark levels are presented in Table 10-6-8. HQs were above 1 for DDD, DDE, and arsenic. However, DDD and DDE are below their respective basewide levels (50 ppb and 40 ppb). Arsenic is naturally occurring in the environment. Since arsenic is the only exceedance, a matrix score of “—” for sediment chemistry is applied.

### **Sediment Toxicity**

Toxicity tests were performed on the marine amphipod *Leptocheirus plumulosus* and the marine polychaete *Neanthes arenacoedentata*, and neither test showed any acute or chronic effects. Results are shown in Table 10-6-9. Survival for both organisms was 100% or above in sediments collected at site 18B-1. Weight measurements of polychaetes recovered after 20 day exposures to Site 18B-1 sediments (8.4 mg) nearly equaled the control organism weights (8.5 mg). Application of these results to the decision making triad discussed in Section 7.14 revealed a triad matrix score of “—” for the amphipod and polychaete tests.

Table 10-6-8 (1)

**Wetland 18****Phase IIB/III Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M18B101</b>					
	4,4'-DDD (UG/KG)	36	1.22	29.51	b
	4,4'-DDE (UG/KG)	6.1	2.07	2.95	b
	Arsenic (MG/KG)	13.8	7.24	1.91	a b
	Chromium (MG/KG)	3.6	52.3	0.07	a b
	Copper (MG/KG)	1.7	18.7	0.09	a b
	Lead (MG/KG)	5.9	30.2	0.20	a b
	Zinc (MG/KG)	5.7	124	0.05	a b

**Notes:**

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.



Table 10-6-9  
 Toxicity Test Results  
 Wetland 18 Sediment

Site	<i>Leptocheirus</i>	<i>Neanthes</i>	Weight (mg)	Triad Matrix Scoring
	% Survival	% Survival		
Control (negative)	99	100	8.5	
Wetland 18 (18-01)	100	100	8.4	—

Note:

\* = Statistically significant difference from control population.

### Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. Location 18-01 exhibited a lower diversity (2.36), when compared to other estuarine wetlands. A total of 43 organisms were collected and sorted into four dominant species. Common marsh representatives such as polychaete worms and corbiculid clams were found at this location. The highest number of individuals collected (22), was *Capitella capitata*, the polychaete worm which is commonly found in highly organic areas and areas suffering from human impacts. Two representatives of the earthworm family, *Lumbriculus*, were collected indicating the low salinity in this area. Although benthic diversity is lower than the reference wetlands, there is no indication of direct toxicity. Benthic diversity results and application to the toxicity test results are presented in Table 10-6-10. Application of these results to the decision making triad discussed in Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-6-10  
 Benthic Diversity Results and Application to the Toxicity Test Results  
 Wetland 18 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 18 (18-01)	2.36	1.03	9.73	—

Table 10-6-11 presents the interpretation of the triad analysis for the Wetland 18 Phase IIB/III sediment samples. Based on the results of the chemistry and toxicity data, condition 2 exists. This can now be applied to the Simplified Decision Flow Chart for Sediment, as presented in Figure 7-2.

Table 10-6-11  
 Triad Analysis Interpretation  
 Wetland 18 Sediment

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 18	—	—	—	Strong evidence for the absence of pollution induced degradation.

Condition number 2 denotes that Wetland 18 sediments are acceptable and no further action is recommended for sediment for this wetland.

#### Protection of Fish Viability:

Protection of fish viability was evaluated using two lines of evidence for Wetland 18B. The first line of evidence, a direct comparison of tissue residue concentrations to toxic effects thresholds in Level 3 fish, shows that no one contaminant had an HQ above 1. Although mercury bioaccumulates, mercury was not detected in Wetland 18 sediment, therefore it was not included in this model. The comparison is provided in Table 10-6-12.

Table 10-6-12  
 Contaminant HQ Calculations from Fish Tissue Samples  
 Wetland 18B

Constituent	Level 3 Fish Tissue Conc (Fg/kg)	Level 3 Fish Tissue Conc. (mg/kg)	Screening Ecotoxicity Values (mg/kg)	HQ
4,4-DDT	ND	ND	0.10 <sup>1</sup>	NA
4,4-DDE	61.0	0.061	0.10 <sup>1</sup>	0.61
4,4-DDD	68.0	0.068	0.10 <sup>1</sup>	0.68
Alpha-Chlordane	1.40	0.0014	1.66 <sup>2</sup>	0.00084
Aroclor 1260	87.00	0.087	0.98 <sup>3</sup>	0.089

**Notes:**

- 1 0.10 mg/kg NOED for mortality in the spiny dogfish, from Guarino, A.M, and S.T. Arnold (1979).
- 2 16.6 mg/kg LOED for mortality in the pinfish, from Parrish, P.R., Schimmel, Hanson, D. J., S.C., Patrick, J.M., and J. Forester (1976).
- 3 0.98 mg/kg NOED for mortality in the pinfish, from Duke, T.W., Lowe, J.L., and A.J. Wilson, Jr. (1970).

For the second line of evidence, risk to Level 4 fish were also evaluated. An HQ greater than 1 was calculated for Aroclor-1260 using an SFF of 1. Using an SFF of 0.000625, risks were not predicted to Level 4 fish from exposure to any chlorinated compounds. These results are shown on Table 10-6-13.

In evaluating risk to Level 4 fish using an SFF of 0.000625, risks were not predicted to level 4 fish from exposure to any chlorinated compound. Only one parameter (Aroclor-1260) had an HQ slightly above 1 using an SFF of 1 for the level 4 fish. These results are shown on Table 10-6-13.

#### **10.6.5 Human Health Risk Assessment**

##### **10.6.5.1 Samples Included**

###### **Sediment**

041M18A101, 041M18A201, 041M18A301, 041M18B101, 001M001801

###### **Surface Water**

041W18A201, 041W18B101, 001W001801

###### **Fish Tissue**

041J18B101

##### **10.6.5.2 Current and Future Land Use**

Wetland 18 is near a Boy Scout campground and family recreation area. Fishing and swimming could occur. More than 50% of the sediment at Wetland 18 is exposed for most of the year, so assuming sediment exposure would be similar to soil exposure is more representative for this wetland than many others. Dermal contact could be a significant exposure pathway and was included in this HHRA; however, game fish habitat is generally limited, so fishing would not be expected. The habitat could support recreational fish, so temporary exposure to fish larvae could occur before the species become too large and are forced to find deeper open water. Fishing is likely in the open water area near Wetland 18.

TABLE 10-6-13  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 18 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	Concentration Used for Screening	Background Value	(4) Adolescent Trespasser Screening Toxicity Value	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Selection	
106467	1,4-Dichlorobenzene	1100.0000	J	1100.0000	J	UG/KG	041M18A201	1 / 5	1900.00 - 3600.00	1100.00	1100	N/A	920000	27000	C	N/A	NO	BSL
78933	2-Butanone (MEK)	98.0000	J	120.0000	J	UG/KG	041M18B101	2 / 5	91.00 - 140.00	109.00	120	N/A	190000000	4700000	N	N/A	NO	BSL
72548	4,4'-DDD	16.0000	D	930.00		UG/KG	001M001801	5 / 5	NAV	285.00	930	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	14.0000	J	270.0000	D	UG/KG	041M18A101	4 / 5	50.00 - 50.00	122.75	270	N/A	65000	1900	C	N/A	NO	BSL
50293	4,4'-DDT	1.9000	J	1800.0000	D	UG/KG	041M18A301	4 / 5	37.00 - 37.00	827.98	1800	N/A	65000	1900	C	N/A	NO	BSL
106445	4-Methylphenol (p-Cresol)	170.0000	J	330.0000	J	UG/KG	041M18A301	2 / 5	1900.00 - 3600.00	250.00	330	N/A	1600000	39000	N	N/A	NO	BSL
67641	Acetone	440.0000	J	750.0000		UG/KG	041M18A101	3 / 5	91.00 - 100.00	556.67	750	N/A	32000000	780000	N	N/A	NO	BSL
309002	Aldrin	3.7000		3.7000		UG/KG	041M18A201	1 / 5	0.82 - 24.00	3.70	3.7	N/A	1300	38	C	N/A	NO	BSL
5103719	alpha-Chlordane	4.8000	J	12.0000	J	UG/KG	001M001801	2 / 5	0.82 - 24.00	8.40	12	N/A	63000	1800	C	N/A	NO	BSL
7429905	Aluminum (Al)	1550.0000		11100.00		MG/KG	041M18B101	5 / 5	NAV	6608.00	11100	N/A	320000	7800	N	N/A	NO	BSL
7440382	Arsenic (As)	2.9000	J	83.80		MG/KG	041M18A301	5 / 5	NAV	25.88	83.8	N/A	15	0.43	C	N/A	YES	ASL
7440393	Barium (Ba)	10.9000	J	35.90		MG/KG	001M001801	5 / 5	NAV	21.78	35.9	N/A	22000	550	N	N/A	NO	BSL
71432	Benzene	34.0000	J	50.0000	J	UG/KG	041M18A101	2 / 5	43.00 - 110.00	42.00	50	N/A	780000	22000	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.7300	J	0.7300	J	MG/KG	041M18B101	1 / 5	0.38 - 2.30	0.73	0.73	N/A	630	16	C	N/A	NO	BSL
319857	beta-BHC	1.3000	J	1.3000	J	UG/KG	041M18A201	1 / 5	0.82 - 24.00	1.30	1.3	N/A	12000	350	C	N/A	NO	BSL
7440702	Calcium (Ca)	228.0000	J	6840.00	J	MG/KG	041M18A101	5 / 5	NAV	3651.60	6840	N/A	N/A	N/A	N/A	N/A	NO	EN
108907	Chlorobenzene	46.0000	J	430.0000		UG/KG	041M18A201	2 / 5	43.00 - 110.00	238.00	430	N/A	6300000	160000	N	N/A	NO	BSL
7440473	Chromium (Cr)	5.8000		66.2000		MG/KG	041M18A201	4 / 5	11.10 - 11.10	21.80	66.2	N/A	1600	39	N	N/A	NO	BSL
7440508	Copper (Cu)	5.2000	J	22.6000		MG/KG	041M18A101	4 / 5	23.00 - 23.00	14.30	22.6	N/A	13000	310	N	N/A	NO	BSL
57125	Cyanide (CN)	8.8000	J	8.8000	J	MG/KG	041M18B101	1 / 5	3.70 - 5.70	8.80	8.8	N/A	6300	160	N	N/A	NO	BSL
84742	Di-n-butylphthalate	160.0000	J	430.0000	J	UG/KG	041M18A301	3 / 5	1900.00 - 3600.00	253.33	430	N/A	32000000	780000	N	N/A	NO	BSL
72208	Endrin	13.0000	J	13.0000	J	UG/KG	001M001801	1 / 5	1.70 - 50.00	13.00	13	N/A	95000	2300	N	N/A	NO	BSL
53494705	Endrin ketone	6.5000	J	6.5000	J	UG/KG	041M18A201	1 / 5	1.70 - 50.00	6.50	6.5	N/A	95000	2300	N	N/A	NO	BSL
5103742	gamma-Chlordane	9.5000	J	9.5000	J	UG/KG	001M001801	1 / 5	0.62 - 24.00	9.50	9.5	N/A	63000	1800	C	N/A	NO	BSL
7439896	Iron (Fe)	805.0000		128000.00		MG/KG	041M18A301	5 / 5	NAV	40681.00	128000	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	45.4000		111.00		MG/KG	041M18A301	5 / 5	NAV	71.16	111	N/A	400	400	O	OSWER	NO	BSL
7439954	Magnesium (Mg)	206.0000	J	3420.00		MG/KG	041M18A201	5 / 5	NAV	1395.40	3420	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	15.3000		105.00		MG/KG	041M18A301	5 / 5	NAV	55.04	105	N/A	15000	1100	N	N/A	NO	BSL
75092	Methylene chloride	750.0000		750.0000		UG/KG	041M18A101	1 / 5	43.00 - 100.00	750.00	750	N/A	2900000	85000	C	N/A	NO	BSL
91203	Naphthalene	300.0000	J	300.0000	J	UG/KG	041M18A201	1 / 5	190.00 - 3600.00	300.00	300	N/A	13000000	310000	N	N/A	NO	BSL
7440097	Potassium (K)	151.0000	J	846.0000	J	MG/KG	041M18B101	4 / 5	5440.00 - 5440.00	393.25	846	N/A	N/A	N/A	O	N/A	NO	EN
7782492	Selenium (Se)	2.2000		3.8000		MG/KG	041M18A301	3 / 5	1.70 - 8.30	2.97	3.8	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	153.0000	J	3300.00		MG/KG	001M001801	5 / 5	NAV	1002.40	3300	N/A	N/A	N/A	N/A	N/A	NO	EN
108883	Toluene	85.0000	J	220.0000	J	UG/KG	041M18A201	2 / 5	43.00 - 110.00	152.50	220	N/A	63000000	1600000	N	N/A	NO	BSL
7440622	Vanadium (V)	7.3000	J	50.9000		MG/KG	041M18B101	4 / 5	16.00 - 16.00	18.85	50.9	N/A	2200	55	N	N/A	NO	BSL
7440656	Zinc (Zn)	6.7000	J	49.30		MG/KG	041M18A201	5 / 5	NAV	19.24	49.3	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background concentrations were calculated for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) RBCs for residential scenario taken from Region III Risk-Based Concentration Tables, (USEPA, 1988).

(6) Rationale Codes Selection Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.6.5.3 Sediment COPCs**

As shown in Table 10-6-13, the following sediment COPC was identified:

- Arsenic

#### **10.6.5.4 Surface Water COPCs**

As shown in Table 10-6-14, the following surface water COPC was identified:

- Arsenic

#### **10.6.5.5 Fish Tissue COPCs**

As shown in Table 10-6-15, the following chemicals were identified as COPCs:

- 4,4'-DDD
- 4,4'-DDE
- PCB Aroclor-1260
- alpha-Chlordane

#### **10.6.5.6 Risk Characterization**

##### ***Sediment and Surface Water***

As shown in Tables 10-6-16 through 10-6-20, arsenic is the only contributor to risk in sediment and surface water. Wetland 18 risk and hazard estimates for sediment and surface water are summarized on Table 10-6-20. The cumulative risk estimated for this wetland is  $1.3E-5$  and the HI was estimated to be 0.1. Arsenic was identified as a COC in sediment and surface water based on its contribution to the cumulative risk estimate for this wetland. Tables 10-6-16 through 10-6-19 detail cancer and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below.

TABLE 10-6-14  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Exposure Medium: Surface Water  
Exposure Point: Wetland 18 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	(2) Background Value	(3) Adolescent Site Trespasser Screening Toxicity Value	(4) Tap Water RBC	(4) Potential ARAR/TB C Source	(4) COPC Flag	(5) Rationale for Contaminant Selection or Detection
106467	1,4-Dichlorobenzene	1.000		2.0000		UG/L	041W18A201	2 / 3	NAV	1.50	2	N/A	41	0.47	C	N/A	BSL
7429905	Aluminum (Al)	119.000	J	1220.0000		UG/L	041W18A201	3 / 3	NAV	525.33	1220	N/A	120000	3700	N	N/A	BSL
7440382	Arsenic (As)	68.300		68.3000		UG/L	041W18A201	1 / 3	NAV	68.30	68.3	N/A	5.6	0.045	C	N/A	ASL
7440393	Barium (Ba)	26.200	J	26.2000	J	UG/L	041W18A201	1 / 3	NAV	26.20	26.2	N/A	6300	260	N	N/A	BSL
71432	Benzene	1.000		5.0000		UG/L	041W18A201	2 / 3	NAV	3.00	5	N/A	91	0.36	C	N/A	BSL
7440702	Calcium (Ca)	3060.000		9420.0000		UG/L	041W18A201	3 / 3	NAV	6746.67	9420	N/A	N/A	N/A	N/A	N/A	EN
108907	Chlorobenzene	5.000		14.0000		UG/L	041W18A201	2 / 3	NAV	9.50	14	N/A	420	3.5	N	N/A	BSL
7440473	Chromium (Cr)	15.600		15.6000		UG/L	041W18A201	1 / 3	NAV	15.60	15.6	N/A	360	11	N	N/A	BSL
7439896	Iron (Fe)	848.000		122000.0000		UG/L	041W18B101	3 / 3	NAV	44582.67	122000	N/A	N/A	N/A	N	N/A	EN
7439921	Lead (Pb)	12.200		12.2000		UG/L	041W18A201	1 / 3	NAV	12.20	12.2	N/A	15	15	N	TTAL	BSL
7439954	Magnesium (Mg)	1110.000		7280.0000		UG/L	041W18B101	3 / 3	NAV	3413.33	7280	N/A	N/A	N/A	N/A	N/A	EN
7439965	Manganese (Mn)	47.600		144.0000		UG/L	041W18A201	3 / 3	NAV	100.53	144	N/A	2400	73	N	N/A	BSL
7440097	Potassium (K)	901.000		3600.0000	J	UG/L	041W18B101	3 / 3	NAV	2147.00	3600	N/A	N/A	N/A	N/A	N/A	EN
7440235	Sodium (Na)	5340.000		48300.0000		UG/L	041W18B101	3 / 3	NAV	19933.33	48300	N/A	N/A	N/A	N/A	N/A	EN
7440622	Vanadium (V)	10.000	J	10.0000	J	UG/L	041W18A201	1 / 3	NAV	10.00	10	N/A	830	26	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value

(3) RBCs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs taken from Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-6-15  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Exposure Medium: Fish  
Exposure Point: Wetland 18 Fish

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Subsistence Fisherman Screening Toxicity Value	Potential ARAR/TB C Source	COPC Flag	(6) Rationale for Contaminant Deletion or
72548	4,4'-DDD	68		68		UG/KG	041J18B101	1 / 1	NAV	68	680	N/A	13.1 C	N/A	YES	ASL
72559	4,4'-DDE	61		61		UG/KG	041J18B101	1 / 1	NAV	61	610	N/A	9.3 C	N/A	YES	ASL
11096825	Aroclor-1260	87	J	87	J	UG/KG	041J18B101	1 / 1	NAV	87	609	N/A	1.6 C	N/A	YES	ASL
5103719	alpha-Chlordan	1.4	J	1.4	J	UG/KG	041J18B101	1 / 1	NAV	1.4	14	N/A	9 C	N/A	YES	ASL

(1) Minimum/maximum detected concentration

(2) Maximum concentration, adjusted by a trophic transfer coefficient, used as screening value.

(3) No background concentrations was calculated for this media.

(4) RBCS for subsistence fisher scenario taken from USEPA Region III Risk-Based Concentration Tables, 1998.

(6) Rationale Codes  
 Selection Reason: Above Screening Levels (ASL)  
 Deletion Reason: Below Screening Levels (BSL)  
 Background Levels (BKG)  
 No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-6-16  
CALCULATION OF CANCER RISKS  
SEDIMENT EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 18  
Receptor Population:  
Trespasser

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	83.8	MG/KG	N/A	M	3.79E-06	mg/kg-day	1.5	mg/kg-day	6E-06
Dermal	Arsenic	83.8	MG/KG	N/A	M	1.55E-07	mg/kg-day	7.5	mg/kg-day	1E-06
Total Risk All Exposure Routes/Pathways										7E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



TABLE 10-6-17  
CALCULATION OF HAZARD QUOTIENTS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 18  
Receptor Population:  
Trespasser

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	83.8	MG/KG	N/A	M	2.65E-05	mg/kg-day	3.00E-04	mg/kg-day	9E-02
Dermal	Arsenic	83.8	MG/KG	N/A	M	4.35E-07	mg/kg-day	6.00E-05	mg/kg-day	7E-03
Total Hazard Index Across All Exposure Routes/Pathways										1E-01

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-6-18  
CALCULATION OF CANCER RISKS  
SURFACE WATER EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 18  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.0683	MG/L	N/A	M	4.02E-06	mg/kg-day	1.5	mg/kg-day	6E-06
Dermal	Arsenic	0.0683	MG/L	N/A	M	8.35E-07	mg/kg-day	7.5	mg/kg-day	4E-07
Total Risk										6E-06

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-6-19  
CALCULATION OF HAZARD QUOTIENTS  
SURFACE WATER EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 18  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.0683	MG/L	N/A	M	2.81E-05	mg/kg-day	3.00E-04	mg/kg-day	6E-03
Dermal	Arsenic	0.0683	MG/L		M	5.85E-06	mg/kg-day	6.00E-05	mg/kg-day	7E-03
Total Hazard Index										1E-02

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-6-20  
RISK SUMMARY  
SEDIMENT AND SURFACE WATER EXPOSURE  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Receptor Population: Site  
Trespasser

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total
Sediment	Sediment	Wetland 3	Arsenic	6E-06	1E-06	7E-06	Arsenic	skin	9E-02	7E-03	1E-01
			(Total)	6E-06	1E-06	7E-06			(Total)	9E-02	7E-03
Surface Water	Surface Water	Wetland 3	Arsenic	6E-06	4E-07	6E-06	Arsenic	skin	6E-03	7E-03	1E-02
			(Total)	6E-06	4E-07	6E-06			(Total)	6E-03	7E-03
Total Risk Across All Pathways						1E-05	Total Hazard Index Across All Pathways				1E-01

### ***Fish Tissue***

#### ***Recreational Fishermen***

For carcinogenic risks (Table 10-6-21), cumulative risk using the modified 95<sup>th</sup> percentile fish ingestion rates (4.3 g/day) is below the 1E-06 threshold. For noncarcinogenic effects (Table 10-6-22), the calculated hazard index is below the threshold level of 1.

#### ***Subsistence Fishermen***

For carcinogenic risks (Table 10-6-23), the cumulative risk for hypothetical subsistence fishermen based on the modified 95<sup>th</sup> percentile fish ingestion rate (19.5 g/day) is below the 1E-06 threshold level. For noncarcinogenic effects (Table 10-6-24), the calculated hazard index is below the threshold level of 1.

A summary of the risk estimates for both the recreational and subsistence fishermen populations is presented in Table 10-6-25.

#### **10.6.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1995). Because arsenic was identified as a COC for surface water and sediment based only on cancer risk estimates, only risk based RGOs were developed. As shown in Table 10-6-16, the sediment exposure point concentration of 83.8-mg/kg-day resulted in a risk estimate of 6.9E-6 for arsenic under an adolescent trespasser scenario. Using a linear ratio, a target risk of 1E-6 would result from 12.24 mg/kg. Therefore, 122.4 mg/kg and 1224 mg/kg represent target risks of 1E-5 and 1E-4, respectively.

RGOs for arsenic in surface water for the adolescent trespasser are 0.0113 mg/L, 0.113 mg/L, and 1.13 mg/L for 1E-6, 1E-5, and 1E-4, respectively.

TABLE 10-6-21  
CALCULATION OF CANCER RISKS  
RECREATIONAL FISH INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 18  
Receptor Population: Recreational

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake (Cancer)	Intake (Cancer) Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDD	6.8E-02	mg/kg	5.5E-09	mg/kg-day	2.4E-01	(mg/kg-day) <sup>-1</sup>	1E-09
4,4'-DDE	6.1E-02	mg/kg	5.5E-09	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	2E-09
Aroclor-1260	8.7E-02	mg/kg	8.1E-09	mg/kg-day	2.0E+00	(mg/kg-day) <sup>-1</sup>	2E-08
Chlordane	1.40E-03	mg/kg	6.9E-11	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	2E-11
Total Pathway Risk							2E-08

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> No risk can be calculated because slope factor does not exist and chemical is not considered carcinogenic.

TABLE 10-6-22  
CALCULATION OF HAZARD QUOTIENTS  
RECREATIONAL FISH INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 18  
Receptor Population: Recreational

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake (Noncarcinogenic )	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDD <sup>2</sup>	6.8E-02	mg/kg	1.3E-08	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDE <sup>2</sup>	6.1E-02	mg/kg	1.3E-08	mg/kg-day	NA	mg/kg-day	NA
Aroclor-1260 <sup>2</sup>	8.7E-02	mg/kg	1.9E-08	mg/kg-day	NA	mg/kg-day	NA
Chlordane	1.40E-03	mg/kg	1.6E-10	mg/kg-day	5.0E-04	mg/kg-day	3E-07
Total Pathway HI							3E-07

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.

TABLE 10-6-23  
CALCULATION OF CANCER RISKS  
SUBSISTENCE FISH INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 18  
Receptor Population: Hypothetical Subsistence

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDD	6.8E-02	mg/kg	2.5E-08	mg/kg-day	2.4E-01	(mg/kg-day) <sup>-1</sup>	6E-09
4,4'-DDE	6.1E-02	mg/kg	2.5E-08	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	9E-09
Aroclor-1260	8.7E-02	mg/kg	3.7E-08	mg/kg-day	2.0E+00	(mg/kg-day) <sup>-1</sup>	7E-08
Chlordane	1.40E-03	mg/kg	3.2E-10	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	1E-10
Total Pathway Risk							9E-08

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> No risk can be calculated because slope factor does not exist and chemical is not considered carcinogenic.



TABLE 10-6-24  
CALCULATION OF HAZARD QUOTIENTS  
SUBSISTENCE FISH INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 18  
Receptor Population: Hypothetical Subsistence

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDD <sup>2</sup>	6.8E-02	mg/kg	5.9E-08	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDE <sup>2</sup>	6.1E-02	mg/kg	5.9E-08	mg/kg-day	NA	mg/kg-day	NA
Aroclor-1260 <sup>2</sup>	8.7E-02	mg/kg	8.7E-08	mg/kg-day	NA	mg/kg-day	NA
Chlordane	1.40E-03	mg/kg	7.5E-10	mg/kg-day	5.0E-04	mg/kg-day	1E-06
<b>Total Pathway HI</b>							<b>1E-06</b>

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.

TABLE 10-6-25  
RISK SUMMARY  
FISH TISSUE INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and  
Future  
Medium: Fish tissue  
Exposure Route : Ingestion

			Recreational Fishermen		Subsistence Fishermen	
Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Hazard Quotient	Cancer Risk	Hazard Quotient	Cancer Risk
4,4'-DDD	6.8E-02	mg/kg	NA	1E-09	NA	6E-09
4,4'-DDE	6.1E-02	mg/kg	NA	2E-09	NA	9E-09
Aroclor-1260	8.7E-02	mg/kg	NA	2E-08	NA	7E-08
Chlordane	1.40E-03	mg/kg	3E-07	2E-11	1E-06	1E-10
<b>Cumulative HI / Cancer Risk</b>			3E-07	2E-08	1E-06	9E-08

N/A - Not applicable (value cannot be determined due to lack of toxicological reference information)

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

#### **10.6.6 Conclusions and Recommendations**

Wetland 18 was sampled in Phase IIB/III to represent the Group C wetlands. Phase IIB/III assessment endpoint and triad analyses revealed that sediment and surface water were acceptable at this wetlands. The HHRA identified arsenic as a COPC for sediment and surface, and several pesticides as fish tissue COPCs. However, the thick foliage surrounding the wetland and the potential for encountering poisonous snakes, such as the cottonmouth, are likely deterrents for most trespassers. The wetland also has no value for recreational fishing, and provides limited habitat for lower trophic level fish.

Because of the lack of excess ecological risk at Wetland 18, the restricted access to human trespassing within the area, and limited human health risk associated with fish consumption from this area, no further action is recommended for Wetland 18.

## 10.7 Wetland 10

### 10.7.1 Site Description

Wetland 10 lies at the southern end of Magazine Point. Parsons and Pruitt divided this water body into two parts, 10A and 10B (USEPA, 1991). Wetland 10A was classified as a palustrine emergent system, while Wetland 10B was designated an estuarine emergent system.

Wetland 10A is a man-made drainage ditch which receives storm water runoff from the northern part of Chevalier Field and the southern area of Magazine Point. Overgrown, with stagnant standing water, Wetland 10A is connected to Wetland 10B via a culvert which runs under a service road. Wetland 10B once had a connection to Pensacola Bay. A four foot high man-made sand berm, constructed since the Site 41 Phase IIA field work was performed in late 1995, now keeps Wetland 10B from being tidally influenced. Wetland 10B now drains by percolation to groundwater.

Wetlands 10A and B are surrounded by scattered pine trees and weedy shrubs. Various aquatic plants, including cattails (*Typha latifolia*), duckweed (*Lemna, sp.*), and other aquatic weeds grow in Wetland 10A. The open water portion of Wetland 10 ranges from 1 to 4 feet in depth, and 12 to 20 feet in width. Sediment in both wetlands is very sandy, with TOC values below 1%.

IR sites potentially affecting Wetland 10 include Sites 32, 33, and 35 (OU 10). Site 32 is the former industrial waste sludge drying beds. Site 33 includes the wastewater treatment plant ponds (including the former surge pond, the stabilization pond, and the polishing pond). Site 35 includes the solid waste management units of the former Industrial Wastewater Treatment Plant (NEESA, 1983).

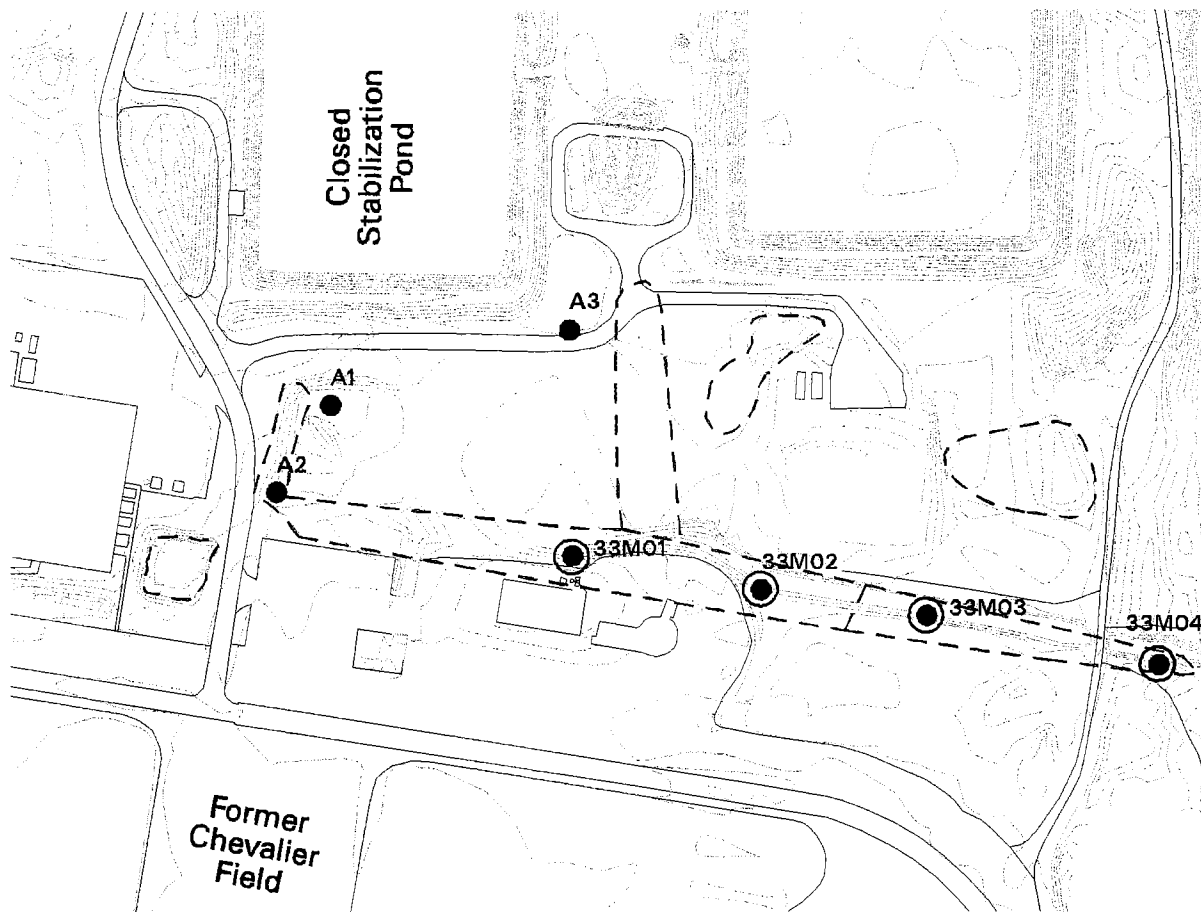
### **10.7.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-7-1 denotes Phase IIA Wetland 10 sampling locations.

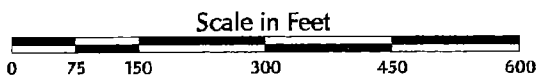
#### **Sediment**

Twenty-one metals were detected in Wetland 10 sediment samples. Five metals — cadmium (2.8 ppm, 34.6 ppm, and 1.7 ppm at locations 33M02, 33M04, and 10A3), chromium (79 ppm and 1,180 ppm at locations 33M02 and 33M04), copper (45.1 ppm at location 33M04), lead (161 ppm and 49.9 ppm at locations 33M04 and 10A3), and nickel (52.1 ppm at location 33M04) — exceeded sediment benchmark levels. Fourteen pesticides were detected in Wetland 10 sediment samples: 4,4'-DDT and its metabolites, aldrin, delta/gamma-BHC, endosulfan I, heptachlor, heptachlor epoxide, endrin, endrin aldehyde, dieldrin, and alpha/gamma-chlordane. 4,4'-DDE exceeded the basewide level (40 ppb) at location 33M02 (54 ppb). 4,4'-DDD (120 ppb), 4,4'-DDE (96 ppb) and 4,4'-DDT (48 ppb) exceeded basewide levels at location 33M03. No other pesticides exceeded its sediment benchmark level. Aroclor-1260 exceeded its sediment screening value (21.6 ppb) at location 33M01 (49 ppb). Sixteen SVOCs were detected in Wetland 10 sediment samples, including mostly high- and low-molecular weight PAHs. Four PAHs — acenaphthylene (33 ppb, and 32 ppb at locations 10A1 and 10A2); and benzo(a)anthracene (87 ppb), benzo(a)pyrene (110 ppb), and fluoranthene (140 ppb) at sample location 10A1 — exceeded sediment benchmark levels. No other SVOCs exceeded a sediment benchmark level. No VOCs were detected in Wetland 10 sediment samples.

Table 10-7-1 shows the Wetland 10 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-7-2, which lists only the parameters with benchmark levels, compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

FIGURE 10-7-1  
PHASE IIA WETLAND 10  
SAMPLING LOCATIONS

Table 10-7-1  
 Phase IIA Detected Concentrations in Wetland 10 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	7/7	1100 - 8910	3714.29
Antimony (Sb)	1/7	0.19	0.19
Arsenic (As)	6/7	0.82 - 6.2	2.47
Barium (Ba)	7/7	1.6 - 15.1	6.29
Cadmium (Cd)	4/7	0.27 - 34.6	9.84
Calcium (Ca)	7/7	155 - 3880	1395.01
Chromium (Cr)	7/7	4.9 - 1180	187.623
Cobalt (Co)	1/7	3.9	3.9
Copper (Cu)	5/7	2.4 - 45.1	13.88
Iron (Fe)	7/7	710 - 7420	2268.57
Lead (Pb)	7/7	5.3 - 161	35.01
Magnesium (Mg)	5/7	46.2 - 242	125.6
Manganese (Mn)	7/7	4.1 - 135	30.93
Nickel (Ni)	4/7	1 - 52.1	14.05
Potassium (K)	6/7	19.5 - 493	204.7
Selenium (Se)	1/7	0.2	0.2
Silver (Ag)	1/6	0.32	0.32
Sodium (Na)	4/7	35.2 - 482	186.44
Thallium (Tl)	1/6	1.5	1.5
Vanadium (V)	3/7	4.6 - 16.4	9.31
Zinc (Zn)	7/7	6.7 - 115	33.97
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDE	6/7	0.25 - 96	31.93
4,4'-DDD	4/7	25 - 120	54.5
4,4'-DDT	6/7	0.25 - 48	11.93
Aldrin	2/7	0.078 - 0.12	0.099
alpha-Chlordane	6/7	0.13 - 0.96	0.32
Aroclor-1260	2/7	12 - 49	30.5
delta-BHC	3/7	0.38 - 0.88	0.56
Dieldrin	1/7	0.39	0.39
Endosulfan I	3/7	0.13 - 0.21	0.16

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-7-1  
 Phase IIA Detected Concentrations in Wetland 10 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Pesticides and PCBs (<math>\mu\text{g}/\text{kg}</math>) (Continued)</b>			
Endrin aldehyde	1/7	0.53	0.53
Endrin	2/7	0.41 - 2.3	1.36
gamma-BHC (Lindane)	2/7	0.074 - 0.12	0.097
gamma-Chlordane	3/7	0.27 - 0.82	0.54
Heptachlor	4/7	0.09 - 0.23	0.14
Heptachlor epoxide	3/7	0.1 - 0.84	0.35
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
1,2-Dichlorobenzene	1/7	28	28
1,4-Dichlorobenzene	1/7	31	31
Acenaphthylene	2/7	32 - 33	32.5
Anthracene	1/7	22	22
Benzo(a)anthracene	3/7	27 - 87	61.67
Benzo(a)pyrene	3/7	27 - 110	75
Benzo(b)fluoranthene	2/7	150 - 190	170
Benzo(g,h,i)perylene	3/7	26 - 72	56.33
Benzo(k)fluoranthene	2/7	63 - 74	68.5
bis(2-Ethylhexyl)phthalate (BEHP)	1/7	52	52
Butylbenzylphthalate	1/7	35	35
Chrysene	3/7	30 - 97	68.67
Fluoranthene	4/7	43 - 140	88.75
Indeno(1,2,3-cd)pyrene	3/7	24 - 72	54
Phenanthrene	2/7	22 - 23	22.5
Pyrene	3/7	39 - 110	79.3

**Notes:**

The total number of samples is reduced by the number of rejected samples. However, no positive results were rejected. All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for inorganics which are in milligrams per kilogram (mg/kg) or parts per million.



Table 10-7-2  
Wetland 10  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>033M001001</b>					
033M001001	4,4'-DDD (UG/KG)	1.1	1.22	29.51	b
033M001001	4,4'-DDE (UG/KG)	54 J	2.07	26.04	b
033M001001	4,4'-DDT (UG/KG)	8.8 J	1.19	7.39	b
033M001001	alpha-Chlordane (UG/KG)	0.26 J	1.7	0.15	a
033M001001	Aroclor-1260 (UG/KG)	12 J	21.6	0.56	b
033M001001	Arsenic (MG/KG)	0.82 J	7.24	0.11	a b
033M001001	Cadmium (MG/KG)	2.8	0.68	8.12	b
033M001001	Chromium (MG/KG)	79	52.9	1.51	a b
033M001001	Copper (MG/KG)	9.3	18.7	0.60	a b
033M001001	gamma-BHC (Lindane) (UG/KG)	0.12 J	0.32	0.38	b
033M001001	gamma-Chlordane (UG/KG)	0.52 J	1.7	0.31	a
033M001001	Lead (MG/KG)	5.3	30.2	0.18	a b
033M001001	Zinc (MG/KG)	22.3	124	0.18	a b

<b>033M002001</b>					
033M002001	4,4'-DDD (UG/KG)	36	1.22	29.51	b
033M002001	4,4'-DDE (UG/KG)	54 J	2.07	26.04	b
033M002001	4,4'-DDT (UG/KG)	8.8 J	1.19	7.39	b
033M002001	alpha-Chlordane (UG/KG)	0.26 J	1.7	0.15	a
033M002001	Aroclor-1260 (UG/KG)	12 J	21.6	0.56	b
033M002001	Arsenic (MG/KG)	0.82 J	7.24	0.11	a b
033M002001	Cadmium (MG/KG)	2.8	0.68	8.12	b
033M002001	Chromium (MG/KG)	79	52.9	1.51	a b
033M002001	Copper (MG/KG)	9.3	18.7	0.60	a b
033M002001	gamma-BHC (Lindane) (UG/KG)	0.12 J	0.32	0.38	b
033M002001	gamma-Chlordane (UG/KG)	0.52 J	1.7	0.31	a
033M002001	Lead (MG/KG)	5.3	30.2	0.18	a b
033M002001	Zinc (MG/KG)	22.3	124	0.18	a b

Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb

Basewide level for 4,4'-DDD is 50 ppb

Basewide level for 4,4'-DDT is 20 ppb

**Table 10-7-2**  
**Wetland 10**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M10A001</b>					
	Acenaphthylene (UG/KG)	33 J	5.87	5.62	b
	alpha-Chlordane (UG/KG)	0.19 J	1.7	0.11	a
	Anthracene (UG/KG)	22 J	45.9	0.47	b
	Arsenic (MG/KG)	1.2	7.24	0.17	a b
	Benzo(a)anthracene (UG/KG)	87	74.8	1.16	c
	Benzo(a)pyrene (UG/KG)	110	88.8	1.24	b
	Chromium (MG/KG)	4.9	52.3	0.09	a b
	Chrysene (UG/KG)	97	106	0.90	b
	Copper (MG/KG)	2.4	18.7	0.13	a b
	Fluoranthene (UG/KG)	140	113	1.24	b
	Lead (MG/KG)	8.2	30.2	0.27	a b
	Nickel (MG/KG)	1.6 J	15.9	0.10	a c
	Phenanthrene (UG/KG)	22 J	86.7	0.25	b
	Pyrene (UG/KG)	110	153	0.72	b
	Zinc (MG/KG)	6.7	124	0.05	a b
<b>041M10A004</b>					
	Acenaphthylene (UG/KG)	1.88 J	5.87	0.18	b
	alpha-Chlordane (UG/KG)	1.88 J	1.7	0.08	b
	Anthracene (UG/KG)	3.2 J	45.9	0.08	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-7-2  
Wetland 10  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
U41M10A301	4,4'-DDE (UG/KG)	2.3	2.07	1.11	b
	4,4'-DDT (UG/KG)	0.25 J	1.19	0.21	b
	alpha-Chlordane (UG/KG)	0.16 J	1.7	0.09	a
	Antimony (MG/KG)	0.19 J	12	0.02	a
	Arsenic (MG/KG)	1.7	7.24	0.23	a b
	Benzo(a)anthracene (UG/KG)	27 J	74.6	0.36	b
	Benzo(a)pyrene (UG/KG)	27 J	98.6	0.30	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	52 J	182	0.29	b
	Cadmium (MG/KG)	1.7	0.68	2.50	b
	Chromium (MG/KG)	11.6	52.3	0.22	a b
	Chrysene (UG/KG)	30 J	108	0.28	b
	Copper (MG/KG)	7.4	18.7	0.40	a b
	Fluoranthene (UG/KG)	62	113	0.55	b
	Lead (MG/KG)	49.9 J	30.2	1.65	a b
	Nickel (MG/KG)	1.5 J	15.9	0.09	a b
	Phenanthrene (UG/KG)	23 J	86.7	0.27	b
	Pyrene (UG/KG)	39 J	153	0.25	b
	Zinc (MG/KG)	38.6	121	0.32	a b

#### U41M10A301

4,4'-DDE (UG/KG)	2.3	2.07	1.11	b
4,4'-DDT (UG/KG)	0.25 J	1.19	0.21	b
alpha-Chlordane (UG/KG)	0.16 J	1.7	0.09	a
Antimony (MG/KG)	0.19 J	12	0.02	a
Arsenic (MG/KG)	1.7	7.24	0.23	a b
Benzo(a)anthracene (UG/KG)	27 J	74.6	0.36	b
Benzo(a)pyrene (UG/KG)	27 J	98.6	0.30	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	52 J	182	0.29	b
Cadmium (MG/KG)	1.7	0.68	2.50	b
Chromium (MG/KG)	11.6	52.3	0.22	a b
Chrysene (UG/KG)	30 J	108	0.28	b
Copper (MG/KG)	7.4	18.7	0.40	a b
Fluoranthene (UG/KG)	62	113	0.55	b
Lead (MG/KG)	49.9 J	30.2	1.65	a b
Nickel (MG/KG)	1.5 J	15.9	0.09	a b
Phenanthrene (UG/KG)	23 J	86.7	0.27	b
Pyrene (UG/KG)	39 J	153	0.25	b
Zinc (MG/KG)	38.6	121	0.32	a b

#### Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites:  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

## **Surface Water**

Twelve metals were detected in Wetland 10 surface water samples. Aluminum exceeded its criteria at all four locations (1,280 ppb, 953 ppb, 696 ppb, and 737 ppb at locations 33W01, 33W02, 33W03 and 33W04). Cadmium (5.2 ppb), iron (5,110 ppb), and lead (2.4 ppb) exceeded the water quality criteria at location 33W01. Iron (1,090 ppb) also exceeded its criteria at location 33W02. Eight pesticides were detected in Wetland 10 surface water samples, none of which exceeded their criteria. No PCBs or SVOCs were detected in surface water at Wetland 10. Two VOCs, toluene and xylene were detected below their surface water criteria.

Table 10-7-3 shows the Wetland 10 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-7-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Parameters with no water quality criteria are not listed in Table 10-7-4. The HQs will be further discussed ecological risk section.

Table 10-7-3  
 Phase IIA Detected Concentrations in Wetland 10 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (µg/L)</b>			
Aluminum (Al)	4/4	696 - 1280	916.5
Barium (Ba)	4/4	11.9 - 16.1	13.375
Cadmium (Cd)	1/4	5.2	5.2
Calcium (Ca)	4/4	12900 - 14500	13575
Chromium (Cr)	1/4	10.8	10.8
Iron (Fe)	4/4	808 - 5110	1954
Lead (Pb)	1/4	2.4	2.4
Magnesium (Mg)	4/4	2950 - 5470	4597.5
Manganese (Mn)	4/4	11.3 - 280	87.3
Silver (Ag)	1/4	24500	24500
Sodium (Na)	4/4	5050 - 24500	17887.5
Zinc (Zn)	4/4	29 - 39.2	36.05
<b>Pesticides (µg/L)</b>			
4,4'-DDD	2/4	0.041 - 0.11	0.0755
4,4'-DDE	4/4	0.0021 - 0.045	0.018
4,4'-DDT	2/4	0.008 - 0.047	0.0275
Heptachlor	1/4	0.0014	0.0014
Heptachlor epoxide	1/4	0.0013	0.0013
alpha-BHC	2/4	0.0027 - 0.0043	0.0035
alpha-Chlordane	1/4	0.0013	0.0013
gamma-Chlordane	2/4	0.003 - 0.0034	0.0032
<b>VOCs (µg/L)</b>			
Toluene	1/4	2	2
Xylene (Total)	3/4	1 - 2	1.67

*Note:*

All results are in micrograms per liter (µg/L) or parts per billion (ppb).

### 10.7.3 Fate and Transport

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data is lacking, many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was

Table 10-7-4 (1)

## Wetland 10

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>033W002002      Freshwater</b>						
	alpha-BHC	UG/L	0.0043	500.0	0.00001	a
	Aluminum	UG/L	953.0	87.0	10.95402	a
	Chromium	UG/L	10.8	11.0	0.98182	a b
	Iron	UG/L	1,090.0	1,000.0	1.09	a b
	Toluene	UG/L	2.0	175.0	0.01143	a
	Zinc	UG/L	39.2	70.2	0.5584	a b
<b>033W004002      Freshwater</b>						
	Aluminum	UG/L	737.0	87.0	8.47126	a
	gamma-Chlordane	UG/L	0.003	0.0043	0.69767	a b
	Iron	UG/L	808.0	1,000.0	0.808	a b
	Zinc	UG/L	29.0	70.2	0.41311	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

presented in Section 9. Table 10-7-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-7-4.

Table 10-7-5  
 Calculated Sediment Screening Values for Wetland 10

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppb)		(ppm)	(ppm)	
Cadmium	0.774 <sup>a, b</sup>	7.5E+01	5.82	34.6	YES
Chromium	11 <sup>a, b</sup>	1.9E+01	21.1	1180	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	335.5	45.1	NO
Lead	1.71 <sup>a, b</sup>	9E+02	153.9	161	YES
Nickel	104 <sup>a, b</sup>	6.5E+01	677	52.1	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4 DDE	10.5 <sup>a</sup>	1.69E+04	1.77E+07	96	NO
4,4 DDD	0.0064 <sup>a</sup>	3.78E+03	2.42E+03	120	NO
4,4 DDT	0.001 <sup>a, b</sup>	9.95E+03	9.95E+02	48	NO
Acenaphthylene	0.031 <sup>b</sup>	11.74	36.81	33	NO
Total PCBs*	0.014 <sup>a, b</sup>	11.68	16.54	49	YES
Benzo(a)anthracene	0.031 <sup>b</sup>	1.5E+03	4.65E+03	87	NO
Benzo(a)pyrene	0.031 <sup>b</sup>	3.87E+03	1.2E+04	110	NO
Fluoranthene	39.8 <sup>a</sup>	4.05E+02	1.61E+06	140	NO

**Notes:**

\* = based on Aroclor-1260

Kd for organics calculated using foc of 0.00379 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 10 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites UST P ( 13 500-gallon aviation gasoline tanks and pipeline associated with the former Chevalier field), UST K (a 500-gallon fuel oil tank associated with the former Building 3810), UST L (two 8,000-gallon diesel tanks associated with former NADEP Building 3644), Sites 32, 33, 35 and 13, the bilge water plant, and the northern portions of Chevalier Field. During periods of high tide and storm surge, there is a direct surface water drainage through a tidal inlet that enters the wetland from Pensacola Bay to the east. There is also a direct surface water connection to Wetland 12.

Sediment contaminants above benchmark levels (see Table 10-7-2) validate this sediment transport pathway, and by inference surface water as well. Additionally, four inorganics were present in surface water above criteria, further validating the pathway.

#### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential source that would directly contribute contamination to Wetland 10 through this pathway are UST sites K, P, and L. Contamination found in groundwater at these sites validates this pathway.

#### **Transport within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that the surface water and sediment transport will occur to the east through a small tidal inlet connecting the wetland with Pensacola Bay. During periods of very high tides or storm surges some back flushing of surface water will occur within the wetland. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.



#### *Sediment Leaching to Surface Water Pathway*

Eight organics — three pesticides, PCBs, and four semivolatiles — and five inorganics, exceeded their benchmark levels. Three inorganics and PCBs exceeded their calculated SSL (see Table 10-7-5). Notably, two of the inorganics (cadmium and lead) were present in surface water above criteria suggesting a potential for leaching from sediment. The source for contaminants in sediment is likely associated with storm water runoff from asphalted surfaces around former Chevalier Field and possibly the nearby UST sites. Pesticide occurrence is likely a residual from routine applications. However, some measure of the lead concentration in surface water is likely due to partitioning from sediment. Because parameters were detected in sediment above its SSLs in conjunction with its exceedance in surface water, the sediment leaching pathway is considered valid for this wetland.

#### **Transport from the Wetland**

Surface water and sediment from Wetland 10 can be expected to move towards the east into the Pensacola Bay system. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

#### **10.7.4 Ecological Risk Assessment**

HQs for Wetland 10 sediment samples are presented in Table 10-7-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed a HQ above 1 for cadmium (4.12, 50.88, and 2.50 at locations 33M02, 33M04, and 10A3), chromium (1.51 and 22.56 at locations 33M02 and 33M04), copper (2.41 at location 33M04), lead (5.33 and 1.65 at locations 33M04 and 10A3), and nickel (3.28 at location 33M04). 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT had HQs greater than 1 at sample locations 33M01 (30.33, 10.14, and 5.21), 33M02 (29.51, 26.09, and 7.39), and 33M03 (98.36, 46.38, and 40.34). 4,4'-DDE also had a HQ greater than 1 at sample locations 33M04 (8.70) and 10A3 (1.11); while 4,4'-DDT had a HQ above 1 at location 33M04 (6.55). Aroclor-1260 had a HQ greater than 1 at

location 33M01 (2.27). Four PAHs had HQs greater than 1 — acenaphthylene (5.62, and 5.45 at locations 10A1 and 10A2); and benzo(a)anthracene (1.16), benzo(a)pyrene (1.24), and fluoranthene (1.24) at sample location 10A1. Phase IIA surface water results revealed HQs greater than 1 for aluminum (14.71, 10.95, 8.0, and 8.47 at locations 33W01, 33W02, 33W03, and 33W04). HQs were also greater than 1 at sample location 33W01 for cadmium (6.72), iron (5.11), and lead (1.40). The HQ was also greater than 1 for iron (1.09) at sample location 33W02. HQs greater than 1 indicate a potential for excess risk.

Wetland 10 was classified in Group D (all wetlands in this group appear as man-made drainage ditches and have limited ecological receptors) and was not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

### **10.7.5 Human Health Risk Assessment**

#### **10.7.5.1 Samples Included**

##### **Sediment**

041M10A101, 041M10A201, 041M10A301, 033M001001, 033M002001, 033M003001, 033M004001

##### **Surface Water**

033W001002, 033W002002, 033W003002, 033W004002

#### **10.7.5.2 Current and Future Land Use**

Wetland 10 lies north of the NATTC at NAS Pensacola, at the southern end of Magazine Point. It is surrounded by a wooded area, the Bilge Water Plant of the waste water treatment plant, and a fenced compound that formerly held a Whirl Stand used by the former NADEP. The Magazine Point area is posted as a restricted location that is patrolled by base police. Routine grounds maintenance activities periodically performed to control weeds and brush. There is no recreational or fishing use of this area.

#### **10.7.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.7.5.4 Sediment COPCs**

As shown in Table 10-7-6, no sediment COPCs were identified.

#### **10.7.5.5 Surface Water COPCs**

As shown in Table 10-7-7, no surface water COPCs were identified.

#### **10.7.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 10.

#### **10.7.6 Conclusions and Recommendations**

Wetland 10 is a channelized drainage ditch without a viable aquatic community. In addition, this wetland is not considered a significant source of food or habitat. Therefore, as proposed in the approved RI/FS SAP Addendum, (EnSafe, 1997), this wetland was eliminated for further risk characterization. Since no COPCs were identified for Wetland 10, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland 10, no further action is recommended for this wetland.

TABLE 10-7-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Soil  
Exposure Medium: Sediment  
Exposure Point: Wetland 10 Sediment

CAS Number	Chemical	(1)				Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2)		(3)	(4)		(5)		COPC Flag	Rationale for Contaminant Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Residential Soil RBC	Potential ARAR/TBC Source				
95501	1,2-Dichlorobenzene	0.0280	J	0.0280	J	MG/KG	041M10A301	1 / 7	0.40 - 0.43	0.028	0.028	N/A	28000	2300	N	N/A	NO	BSL	
106467	1,4-Dichlorobenzene	0.0310	J	0.0310	J	MG/KG	041M10A301	1 / 7	0.40 - 0.43	0.031	0.031	N/A	92	2.7	C	N/A	NO	BSL	
72548	4,4'-DDD	0.0250	J	0.1200	J	MG/KG	033M001001	4 / 7	0.00021 - 0.00021	0.055	0.12	N/A	92	2.7	C	N/A	NO	BSL	
72559	4,4'-DDE	0.0003	J	0.0960	J	MG/KG	033M002001	5 / 7	0.00021 - 0.00021	0.032	0.096	N/A	65	1.9	C	N/A	NO	BSL	
50293	4,4'-DDT	0.0003	J	0.0480	J	MG/KG	033M003001	6 / 7	0.00021 - 0.00021	0.012	0.048	N/A	65	1.9	C	N/A	NO	BSL	
208968	Acenaphthylene	0.0320	J	0.0330	J	MG/KG	041M10A101	2 / 7	0.04 - 0.43	0.033	0.033	N/A	9500	230	N	N/A	NO	BSL	
309002	Aldrin	0.000078	J	0.0001	J	MG/KG	033M003001	2 / 7	0.0001 - 0.0023	0.00010	0.00012	N/A	1.3	0.038	C	N/A	NO	BSL	
5103719	alpha-Chlordane	0.00013	J	0.0010	J	MG/KG	033M001001	6 / 7	0.0001 - 0.0001	0.00032	0.00096	N/A	6.3	1.8	C	N/A	NO	BSL	
7429905	Aluminum (Al)	1100.0000	J	8910.00	J	MG/KG	041M10A101	8 / 8	NAV	3816.25	8910	N/A	320000	7800	N	N/A	NO	BSL	
120127	Anthracene	0.0220	J	0.0220	J	MG/KG	041M10A101	1 / 7	0.04 - 0.43	0.02	0.022	N/A	95000	2300	N	N/A	NO	BSL	
7440360	Antimony (Sb)	0.1900	J	0.19	J	MG/KG	041M10A101	1 / 8	0.19 - 15.20	0.19	0.19	N/A	130	3.1	N	N/A	NO	BSL	
11096825	Aroclor-1260	0.0120	J	0.0490	J	MG/KG	033M001001	2 / 7	0.0021 - 0.0430	0.03	0.049	N/A	11	0.32	C	N/A	NO	BSL	
7440382	Arsenic (As)	0.8200	J	6.20	J	MG/KG	033M004001	6 / 8	1.00 - 1.40	2.47	6.20	N/A	15	0.43	C	N/A	NO	BSL	
7440393	Barium (Ba)	1.6000	J	15.10	J	MG/KG	033M003001	7 / 8	7.90 - 7.90	6.29	15.1	N/A	22000	550	N	N/A	NO	BSL	
56553	Benzo(a)anthracene	0.0270	J	0.0870	J	MG/KG	041M10A301	3 / 7	0.41 - 0.43	0.06	0.087	N/A	30	0.88	C	N/A	NO	BSL	
50328	Benzo(a)pyrene	0.0270	J	0.1100	J	MG/KG	041M10A101	3 / 7	0.41 - 0.43	0.08	0.11	N/A	3	0.088	C	N/A	NO	BSL	
205992	Benzo(b)fluoranthene	0.1500	J	0.1900	J	MG/KG	041M10A101	2 / 7	0.04 - 0.43	0.17	0.19	N/A	30	0.88	C	N/A	NO	BSL	
191242	Benzo(g,h,i)perylene	0.0260	J	0.0720	J	MG/KG	041M10A201	3 / 7	0.41 - 0.43	0.06	0.072	N/A	9500	230	N	N/A	NO	BSL	
207089	Benzo(k)fluoranthene	0.0630	J	0.0740	J	MG/KG	041M10A201	2 / 7	0.04 - 0.43	0.07	0.074	N/A	300	8.8	C	N/A	NO	BSL	
117817	bis(2-Ethylhexyl)phthalate (BEHP)	0.0520	J	0.0520	J	MG/KG	041M10A301	1 / 7	0.06 - 0.42	0.05	0.052	N/A	1.8	46	C	N/A	NO	BSL	
85687	Butylbenzylphthalate	0.0350	J	0.0350	J	MG/KG	041M10A101	1 / 7	0.14 - 0.41	0.04	0.035	N/A	63000	1600	N	N/A	NO	BSL	
7440439	Cadmium (Cd)	0.2700	J	34.60	J	MG/KG	041M10A201	4 / 8	0.26 - 1.30	9.84	34.6	N/A	320	7.8	N	N/A	NO	BSL	
7440702	Calcium (Ca)	155.0000	J	3880.00	J	MG/KG	041M10A201	8 / 8	NAV	1243.88	3880	N/A	N/A	N/A	N/A	NO	EN	BSL	
7440473	Chromium (Cr)	4.9000	J	1180.00	J	MG/KG	033M002001	7 / 8	-	187.63	1180	N/A	1600	23	N	N/A	NO	BSL	
218019	Chrysene	0.0300	J	0.0970	J	MG/KG	041M10A101	3 / 7	0.41 - 0.43	0.07	0.1	N/A	3000	88	C	N/A	NO	BSL	
7440484	Cobalt (Co)	3.9000	J	3.90	J	MG/KG	041M10A201	1 / 8	0.19 - 3.20	3.90	3.9	N/A	19000	470	N	N/A	NO	BSL	
7440508	Copper (Cu)	2.4000	J	45.10	J	MG/KG	033M002001	6 / 8	6.40 - 6.60	11.97	45.1	N/A	13000	310	N	N/A	NO	BSL	
319868	delta-BHC	0.00038	J	0.0009	J	MG/KG	033M002001	3 / 7	0.00010 - 0.00220	0.00056	0.00088	N/A	12	0.35	C	N/A	NO	BSL	
60571	Dieldrin	0.00039	J	0.0004	J	MG/KG	033M004001	1 / 7	0.00021 - 0.00440	0.00039	0.00039	N/A	1.4	0.04	C	N/A	NO	BSL	
959988	Endosulfan I	0.00013	J	0.0002	J	MG/KG	033M003001	3 / 7	0.00021 - 0.00230	0.00016	0.00021	N/A	1900	47	N	N/A	NO	BSL	
72208	Endrin	0.00041	J	0.0023	J	MG/KG	033M003001	2 / 7	0.00021 - 0.00440	0.00136	0.0023	N/A	95	2.3	N	N/A	NO	BSL	
7421934	Endrin aldehyde	0.00053	J	0.0005	J	MG/KG	033M004001	1 / 7	0.00021 - 0.00440	0.00053	0.00053	N/A	95	2.3	N	N/A	NO	BSL	
206440	Fluoranthene	0.0430	J	0.1400	J	MG/KG	041M10A301	4 / 7	0.41 - 0.43	0.08875	0.14	N/A	13	310	N	N/A	NO	BSL	
58899	gamma-BHC (Lindane)	0.000074	J	0.0001	J	MG/KG	033M001001	2 / 7	0.00010 - 0.00220	0.00010	0.00012	N/A	17	0.49	C	N/A	NO	BSL	
5103742	gamma-Chlordane	0.00027	J	0.0008	J	MG/KG	033M002001	3 / 7	0.00010 - 0.00210	0.00054	0.00082	N/A	6.3	1.8	C	N/A	NO	BSL	
78448	Heptachlor	0.000099	J	0.0002	J	MG/KG	033M004001	4 / 7	0.00010 - 0.00010	0.00014	0.00023	N/A	4.9	0.14	C	N/A	NO	BSL	
1024573	Heptachlor epoxide	0.0001	J	0.0008	J	MG/KG	033M002001	3 / 7	0.0001 - 0.0022	0.00035	0.00084	N/A	2.4	0.07	C	N/A	NO	BSL	
193395	Indeno(1,2,3-cd)pyrene	0.0240	J	0.0720	J	MG/KG	041M10A201	3 / 7	0.41 - 0.43	0.05400	0.072	N/A	30	0.88	C	N/A	NO	BSL	
7439895	Iron (Fe)	710.0	J	7420.00	J	MG/KG	033M003001	8 / 8	NAV	2290.00	7420	N/A	N/A	N/A	N/A	NO	EN	BSL	
7439921	Lead (Pb)	5.3	J	161.00	J	MG/KG	033M004001	8 / 8	NAV	31.56	161	N/A	400	400	N	OSWER	NO	BSL	
7439954	Magnesium (Mg)	49.2000	J	242.00	J	MG/KG	041M10A101	6 / 8	140.00 - 143.00	116.28	242	N/A	N/A	N/A	N/A	NO	EN	BSL	
7439965	Manganese (Mn)	4.1000	J	135.00	J	MG/KG	033M002001	8 / 8	NAV	29.80	135	N/A	15000	1100	N	N/A	NO	BSL	
7440020	Nickel (Ni)	1	J	52.10	J	MG/KG	041M10A201	5 / 8	9.70 - 10.10	11.54	52.1	N/A	6300	190	N	N/A	NO	BSL	
85018	Phenanthrene	0.0220	J	0.0230	J	MG/KG	041M10A301	2 / 7	40.00 - 430.00	0.02	0.023	N/A	9500	230	N	N/A	NO	BSL	
7440097	Potassium (K)	19.5000	J	165.00	J	MG/KG	041M10A301	4 / 8	1010.00 - 1050.00	61.05	165	N/A	N/A	N/A	N/A	NO	EN	BSL	
129000	Pyrene	0.0390	J	0.1100	J	MG/KG	041M10A301	3 / 7	410.00 - 430.00	0.08	0.11	N/A	9500	230	N	N/A	NO	BSL	
7782492	Selenium (Se)	0.2000	J	0.20	J	MG/KG	041M10A301	1 / 8	0.18 - 1.10	0.20	0.2	N/A	1600	39	N	N/A	NO	EN	BSL
7440224	Silver (Ag)	0.3200	J	0.32	J	MG/KG	041M10A101	1 / 8	0.25 - 3.60	0.32	0.32	N/A	1600	39	N	N/A	NO	BSL	
7440235	Sodium (Na)	35.2000	J	482.00	J	MG/KG	041M10A201	5 / 8	2.40 - 30.50	186.44	482	N/A	N/A	N/A	N/A	NO	EN	BSL	
7440280	Thallium (Tl)	1.5000	J	1.50	J	MG/KG	041M10A201	1 / 8	0.18 - 0.79	1.50	1.5	N/A	22	0.55	N	N/A	NO	BSL	
7440622	Vanadium (V)	4.6000	J	16.40	J	MG/KG	041M10A201	4 / 8	3.80 - 4.00	8.98	16.4	N/A	2200	55	N	N/A	NO	BSL	
7440686	Zinc (Zn)	6.7000	J	115.00	J	MG/KG	033M003001	8 / 8	NAV	30.63	115	N/A	95000	2300	N	N/A	NO	BSL	

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1989).

(6) Rationale Codes Selection Reason:

Deletion Reason:

Above Screening Levels (ASL)

Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

**TABLE 10-7-7**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 10 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection	
72548	4,4'-DDD	0.041	J	0.1100	J	UG/L	033W003002	2 / 4	NAV	0.08	0.11	N/A	0.6	0.28	C	N/A	NO	BSL
72559	4,4'-DDE	0.002	J	0.0450	J	UG/L	033W003002	4 / 4	NAV	0.02	0.05	N/A	0.5	0.20	C	N/A	NO	BSL
50293	4,4'-DDT	0.008	J	0.0470	J	UG/L	033W003002	2 / 4	NAV	0.03	0.05	N/A	0.28	0.20	C	N/A	NO	BSL
7429905	Aluminum (Al)	696.000		1280.0000		UG/L	033W001002	4 / 4	NAV	916.50	1280	N/A	120000	3700	N	N/A	NO	BSL
7440393	Barium (Ba)	11.900	J	16.1000	J	UG/L	033W001002	4 / 4	NAV	13.38	16.1	N/A	8300	260	N	N/A	NO	BSL
7440439	Cadmium (Cd)	5.200		5.2000		UG/L	033W001002	1 / 4	NAV	5.20	5.2	N/A	60	1.8	N	N/A	NO	BSL
7440702	Calcium (Ca)	12900.000		14500.0000		UG/L	033W002002	4 / 4	NAV	13575.00	14500	N/A	N/A	N/A	N/A	NO	EN	
7440473	Chromium (Cr)	10.800		10.8000		UG/L	033W002002	1 / 4	NAV	10.80	10.8	N/A	360	11	N	N/A	NO	BSL
76448	Heptachlor	0.001		0.0014	J	UG/L	033W001002	1 / 4	NAV	0.00	0.0014	N/A	0.68	0.0023	C	N/A	NO	BSL
1024573	Heptachlor epoxide	0.001		0.0013	J	UG/L	033W003002	1 / 4	NAV	0.00	0.0013	N/A	0.079	0.0012	C	N/A	NO	BSL
7439896	Iron (Fe)	808.000		5110.0000		UG/L	033W001002	4 / 4	NAV	1954.00	5110	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	2.400	J	2.4000		UG/L	033W001002	1 / 4	NAV	2.40	2.40	N/A	15	15	TTAL	NO	BSL	
7439954	Magnesium (Mg)	2950.000	J	5470.0000		UG/L	033W002002	4 / 4	NAV	4597.50	5470	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	11.300	J	280.0000		UG/L	033W001002	4 / 4	NAV	87.30	280	N/A	2400	73	N	N/A	NO	BSL
7440224	Silver (Ag)	24500.000		24500.0000		UG/L	033W002002	1 / 4	NAV	24500.00	24500	N/A	600	18	N	N/A	NO	BSL
7440235	Sodium (Na)	5050.000		24500.0000		UG/L	033W002002	4 / 4	NAV	17887.50	24500	N/A	N/A	N/A	N/A	NO	EN	
108883	Toluene	2.000	J	2.0000	J	UG/L	033W002002	1 / 4	NAV	2.00	2	N/A	3800	75	N	N/A	NO	BSL
1330207	Xylene (Total)	1.000	J	2.0000	J	UG/L	033W004002	3 / 4	NAV	1.67	2	N/A	19000	1200	N	N/A	NO	BSL
7440666	Zinc (Zn)	29.000		39.2000		UG/L	033W002002	4 / 4	NAV	36.05	39.2	N/A	36000	1100	N	N/A	NO	BSL
319846	alpha-BHC	0.0027		0.0043	J	UG/L	033W002002	2 / 4	NAV	0.00	0.0043	N/A	0.3	0.011	C	N/A	NO	BSL
5103719	alpha-Chlordane	0.0013	J	0.0013	J	UG/L	033W003002	1 / 4	NAV	0.00	0.0013	N/A	2.1	0.19	C	N/A	NO	BSL
5103742	gamma-Chlordane	0.0030		0.0034	J	UG/L	033W001002	2 / 4	NAV	0.00	0.0034	N/A	2.1	0.19	C	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

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## **10.8 Wetland 12**

### **10.8.1 Site Description**

Wetland 12 is south of OU 10, at the base of Magazine Point. Wetland 12 is a freshwater forested wetland, surrounded by pine trees, and primarily fed by rainfall and surface runoff from the surrounding area. Wetland 12 drains surface water into Wetland 10A. Parsons and Pruitt described Wetland 12 as a palustrine forested scrub-shrub system (USEPA, 1991).

Wetland 12's open water, 1 to 2 feet in depth, occurs in a sandy depression, and is filled with cattails (*Typha latifolia*). The surrounding edges of this system support pine trees, and the weedy legume, rattlebox (*Sesbania sp.*). Sediment in Wetland 12 is very sandy, with TOC values to 4%.

IR sites potentially affecting Wetland 12 include Sites 32, 33, and 35 of OU 10. Site 32 is the former industrial waste sludge drying beds. Site 33 includes the wastewater treatment plant ponds (including the former surge pond, the stabilization pond, and the polishing pond). Site 35 includes the solid waste management units of the former Industrial Wastewater Treatment Plant (NEESA, 1983). Wetland 12 also received a spill from the bilge water plant in 1992, with the effects still visible in 1994 and 1995.

### **10.8.2 Nature and Extent**

#### **Sediment**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-8-1 denotes the Phase IIA Wetland 12 sampling locations.

Sixteen metals were detected in Wetland 12 sediment samples. No metals exceeded a sediment benchmark level. Eight pesticides were detected in Wetland 12 sediment samples: 4,4'-DDE, beta/delta-BHC, dieldrin, endosulfan I, endosulfan sulfate, endrin aldehyde, and endrin ketone. Endrin ketone exceeded its benchmark level (3.3 ppm) at sample location 1201 (13 ppm). No

other pesticides exceeded its sediment benchmark level, and no PCBs were detected at Wetland 12. Four PAHs — 2-methylnaphthalene (7,100 ppb), fluorene (1,300 ppb), naphthalene (1,300 ppb) and phenanthrene (2,500 ppb) — exceeded sediment benchmark levels at sample location 1202. Methylene chloride, a common laboratory contaminant, was the only VOC detected in Wetland 12 sediment samples.

Table 10-8-1 shows the Wetland 12 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-8-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the parameters with benchmark levels are presented in Table 10-8-2. The HQs will be further discussed in the ecological risk section.

### **Surface Water**

Ten metals were detected in the Wetland 12 surface water samples. Iron (1,150 ppb) and thallium (12.2 ppb) exceeded their water quality criteria at location 1201. No pesticides or PCBs were detected in Wetland 12 surface water. The only SVOC detection was di-n-butylphthalate, below the applicable criteria. No VOCs were detected in Wetland 12 surface water.

Table 10-8-3 shows the Wetland 12 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-8-4 compares detected concentrations at each sample location to surface water quality criteria, and lists calculated HQs for each parameter. The HQs will be further discussed ecological risk section.

### **10.8.3 Fate and Transport**

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland;



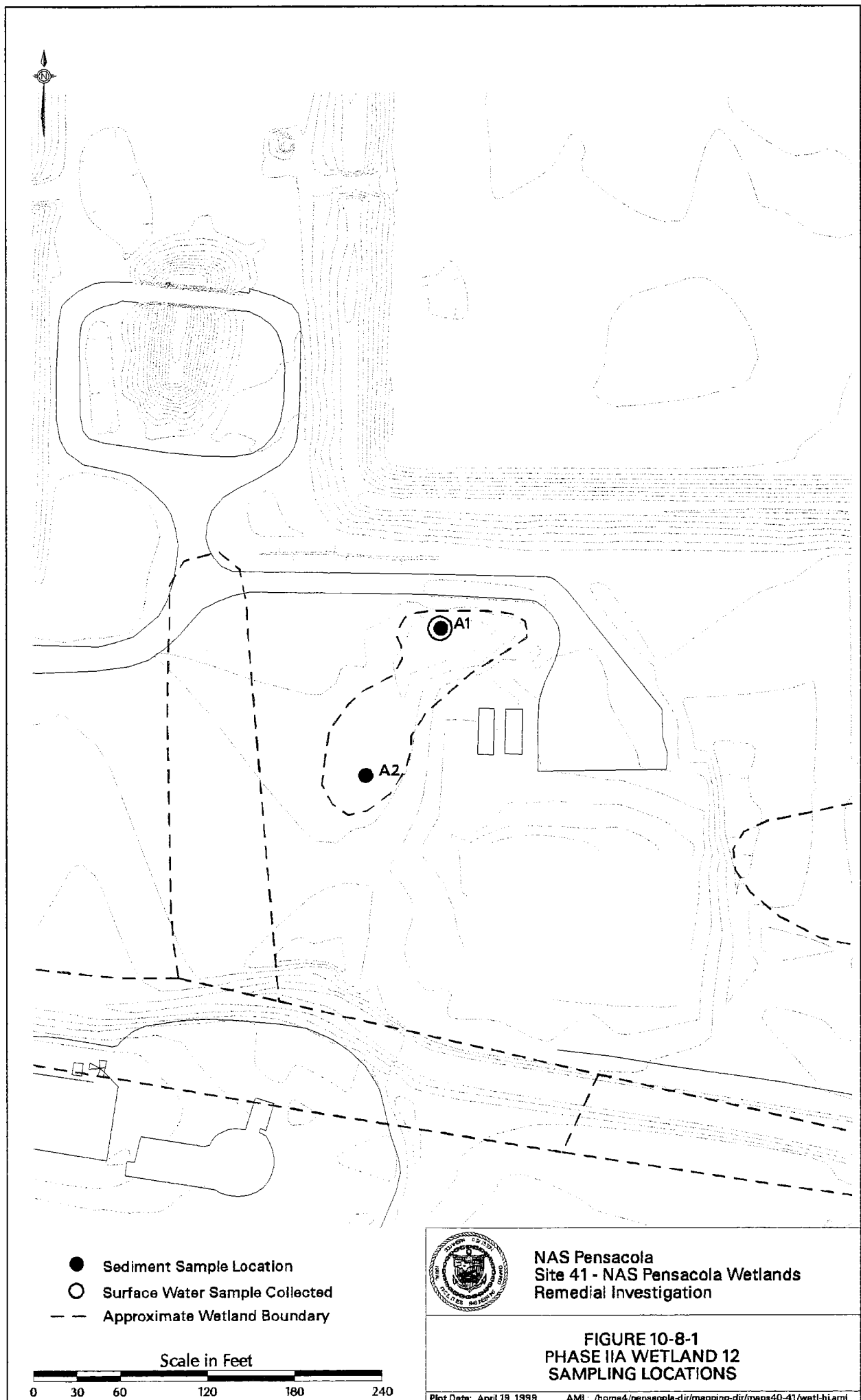


Table 10-8-1  
 Phase IIA Detected Concentrations in Wetland 12 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	2/2	593-3070	1831.5
Arsenic (As)	1/2	0.24	0.24
Barium (Ba)	2/2	0.86-3.1	1.98
Beryllium (Be)	1/2	0.12	0.12
Calcium (Ca)	2/2	1290-1950	1620
Chromium (Cr)	2/2	2.1-4.8	3.45
Copper (Cu)	2/2	0.67-2.9	1.79
Iron (Fe)	2/2	367-484	425.5
Lead (Pb)	2/2	5.1-27.1	16.1
Magnesium (Mg)	2/2	103-468	285.5
Manganese (Mn)	2/2	2.9-7.6	5.25
Potassium (K)	2/2	26.2-138	82.1
Selenium (Se)	1/2	0.43	0.43
Sodium (Na)	2/2	229-1840	1034.5
Vanadium (V)	2/2	1.3-6.6	3.95
Zinc (Zn)	2/2	2.3-3	2.65
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DUE	1/2	0.97	0.97
beta-BHC	1/2	0.89	0.89
delta-BHC	1/2	1.1	1.1
Dieldrin	1/2	0.31	0.31
Endosulfan I	2/2	0.4-1.2	0.8
Endosulfan sulfate	1/2	3.2	3.2
Endrin ketone	1/2	13	13
Endrin aldehyde	1/2	0.28	0.28
<b>SVOCs (μg/kg)</b>			
2-Methylnaphthalene	1/2	7100	7100
Fluorene	1/2	1300	1300
Naphthalene	1/2	1300	1300
Phenanthrene	1/2	2500	2500
<b>VOCs (μg/kg)</b>			
Methylene chloride	1/2	1300	1300

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-B-2  
Wetland 12  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
041M120201					
		1.1	15.1	1.08	15.1
		1.1	15.1	1.08	15.1
		1.1	15.1	1.08	15.1
		1.1	15.1	1.08	15.1
		1.1	15.1	1.08	15.1

**041M120201**

2-Methylnaphthalene (UG/KG)	7100	20.2	051.49	(b)
4,4'-DDE (UG/KG)	0.97	2.07	0.47	(b)
Arsenic (MG/KG)	0.24 (a)	7.24	0.03	a b
Chromium (MG/KG)	4.9 (a)	52.3	0.08	a b
Copper (MG/KG)	2.9	18.7	0.16	a b
Dieldrin (UG/KG)	0.31 (a)	0.72	0.43	b
Endrin aldehyde (UG/KG)	0.28 (a)	3.3	0.08	a
Fluorene (UG/KG)	1300	21.2	61.32	(b)
Lead (MG/KG)	27.1	30.2	0.90	a b
Naphthalene (UG/KG)	1300	34.6	37.57	(b)
Phenanthrene (UG/KG)	2800	66.7	28.84	(b)
Zinc (MG/KG)	3	129	0.02	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SQVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.
- Basewide levels (detailed in Section 6) for DDT and its metabolites
- Basewide level for 4,4'-DDE is 40 ppb.
- Basewide level for 4,4'-DDD is 60 ppb.
- Basewide level for 4,4'-DDT is 20 ppb.

Table 10-8-3  
 Phase IIA Detected Concentrations in Wetland 12 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Calcium (Ca)	1/1	23000	23000
Chromium (Cr)	1/1	8.1	8.1
Iron (Fe)	1/1	1150	1150
Lead (Pb)	1/1	1.2	1.2
Magnesium (Mg)	1/1	38400	38400
Manganese (Mn)	1/1	47.9	47.9
Potassium (K)	1/1	24100	24100
Sodium (Na)	1/1	541000	541000
Thallium (Tl)	1/1	12.2	12.2
Zinc (Zn)	1/1	7.8	7.8
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
Di-n-butylphthalate	1/1	1	1

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data is lacking, many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-8-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-8-4.

### Transport into the Wetland

#### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 12 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 32,33,35, 13, and UST sites L (two 8,000-gallon diesel tanks associated with former NADEP Building 3644), and K (a 500-gallon fuel oil tank associated with the former Building 3810), the Bilge Water Plant, and northern portions of Chevalier Field. This wetland also has a direct connection to Wetland 10, which is directly connected to Pensacola Bay and may experience back flushing during storm surges or excessively high tides.

Table 10-8-4 (1)

## Wetland 12

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W120101</b>	<b>Freshwater</b>					
	Chromium	UG/L	8.1	11.0	0.73636	a b
	Di-n-butylphthalate	UG/L	1.0	3.0	0.33333	b
	Iron	UG/L	1,150.0	1,000.0	1.15	a b
	Lead	UG/L	1.2	1.71	0.70175	a b
	Thallium	UG/L	12.2	4.0	3.05	a
	Zinc	UG/L	7.8	70.2	0.11111	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-8-5  
 Calculated Sediment Screening Values for Wetland 12

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Organics (ppb)</b>					
2-methylnaphthalene	NA	1.8E+02	NA	7,100	NA
Fluorene	14,000 <sup>b</sup>	3.31E+02	4.69E+08	1,300	NO
Napthalene	62 <sup>a</sup>	4.8E+01	2.97E+05	1,300	NO
Phenanthrene	0.031 <sup>b</sup>	7.2E+02	2.24E+03	2,500	YES

**Notes:**

Kd for organics calculated using foc of. 024 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

Sediment contaminants above benchmark levels (see Table 10-8-2) validate this sediment transport pathway, and by inference surface water as well. Additionally, two inorganics were present in surface water above standards that were not detected in sediment, further validating the pathway.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential sources that would directly contribute contamination to Wetland 1 through this pathway are the UST sites L and K. Contamination found in groundwater at these sites validates this pathway.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment transport will occur to the south into Wetland 10 and from there into Pensacola Bay.

During periods of very high tides or storm surges some back flushing of surface water will occur within Wetland 10, and potentially affect Wetland 12. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

#### *Sediment Leaching to Surface Water Pathway*

Four semivolatiles exceeded their sediment benchmark values (see Table 10-8-2), but only one — phenanthrene — exceeded its calculated SSL (see Table 10-8-5). Phenanthrene was not present in the corresponding surface water, however, indicating a low potential for this pathway. In surface water, iron and thallium were present above standards; these are attributable to the surface water/groundwater discharge pathway. Because phenanthrene was detected in sediment above its SSL, the pathway is considered valid, but the potential for that constituent to partition to surface water is low.

#### **Transport from the Wetland**

Surface water and sediment from Wetland 12 can be expected to move into Wetland 10 and eventually into Pensacola Bay. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

#### **10.8.4 Ecological Risk Assessment**

HQs for Wetland 12 sediment samples are presented in Table 10-8-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for endrin ketone at sample location 1201 (3.94). Four PAHs had HQs above 1 at sample location 1202, including 2-methylnaphthalene (351.49), fluorene (61.32), naphthalene (37.57), and phenanthrene (28.84). Phase IIA surface water results revealed HQs greater than 1 for iron (1.15), and thallium (3.05). HQs greater than one indicate a potential for excess risk.

Wetland 12 was not assessed during the Phase IIB/III ecological risk appraisals at Site 41. investigation.

### **10.8.5 Human Health Risk Assessment**

#### **10.8.5.1 Samples Included**

##### **Sediment**

041M120101, 041M0120201

##### **Surface Water**

041W120101

#### **10.8.5.2 Current and Future Land Use**

Wetland 12 lies in a wooded zone north of the NATTC at NAS Pensacola, at the southern end of Magazine Point. Wetland 10 is connected to Wetland 12 to the south. The Bilge Water Plant of the waste water treatment plant is east. The Magazine Point area is posted as a restricted location that is patrolled by base police. Routine grounds maintenance activities are periodically performed to control weeds and brush. There is no recreational or fishing use of this area.

#### **10.8.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.8.5.4 Sediment COPCs**

As shown in Table 10-8-6, no sediment COPCs were identified.

#### **10.8.5.5 Surface Water COPCs**

As shown in Table 10-8-7, the following surface water COPC was identified:

- Thallium



TABLE 10-8-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and  
Future  
Medium: Soil  
Exposure Medium: Sediment  
Exposure Medium: Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
91576	2-Methylnaphthalene	7.1000		7.1000		MG/KG	041M120201	1 / 2	4.10000 - 4.10000	7.1000	7.10	N/A	6300	310	N	N/A	BSL
72559	4,4'-DDE	0.0010		0.0010		MG/KG	041M120201	1 / 2	0.00021 - 0.00021	0.0010	0.0010	N/A	65.03	1.9	C	N/A	BSL
7429905	Aluminum (Al)	593.0000		3070.0000		MG/KG	041M120101	2 / 2	NAV	1831.50	3070.00	N/A	320000	7800	N	N/A	BSL
7440382	Arsenic (As)	0.2400	J	0.2400	J	MG/KG	041M120201	1 / 2	0.17 - 0.17	0.24	0.24	N/A	15	0.43	C	N/A	BSL
7440393	Barium (Ba)	0.8500	J	3.1000	J	MG/KG	041M120201	2 / 2	NAV	1.98	3.10	N/A	22000	550	N	N/A	BSL
7440417	Beryllium (Be)	0.1200	J	0.1200	J	MG/KG	041M120201	1 / 2	0.08 - 0.08	0.12	0.12	N/A	630	16	N	N/A	BSL
319857	beta-BHC	0.0009	J	0.0009	J	MG/KG	041M120101	1 / 2	0.00016 - 0.00016	0.0009	0.0009	N/A	12	0.35	C	N/A	BSL
7440702	Calcium (Ca)	1290.0000	J	1950.0000		MG/KG	041M120201	2 / 2	NAV	1620.00	1950.00	N/A	N/A	N/A	N	N/A	EN
7440473	Chromium (Cr)	2.1000		4.8000	J	MG/KG	041M120101	2 / 2	NAV	3.45	4.80	N/A	1600	23	N	N/A	BSL
7440508	Copper (Cu)	0.6700	J	2.9000		MG/KG	041M120101	2 / 2	NAV	1.79	2.90	N/A	13000	310	N	N/A	BSL
319868	delta-BHC	0.0011	J	0.0011	J	MG/KG	041M120101	1 / 2	0.00016 - 0.00016	0.0011	0.0011	N/A	12	0.35	C	N/A	BSL
60571	Dieldrin	0.0003	J	0.0003	J	MG/KG	041M120201	1 / 2	0.00021 - 0.00021	0.0003	0.0003	N/A	1.4	0.04	C	N/A	BSL
959988	Endosulfan I	0.0004	J	0.0012	J	MG/KG	041M120101	2 / 2	NAV	0.0008	0.0012	N/A	1900	47	N	N/A	BSL
1031078	Endosulfan sulfate	0.0032	J	0.0032	J	MG/KG	041M120201	1 / 2	0.00021 - 0.00021	0.0032	0.0032	N/A	1900	47	N	N/A	BSL
7421934	Endrin aldehyde	0.0003	J	0.0003	J	MG/KG	041M120201	1 / 2	0.00021 - 0.00021	0.0003	0.0003	N/A	95	2.3	N	N/A	BSL
53494705	Endrin ketone	0.0130	DJ	0.0130	DJ	MG/KG	041M120101	1 / 2	0.00032 - 0.00032	0.0130	0.0130	N/A	95	2.3	N	N/A	BSL
86737	Fluorene	1.3000		1.3000		MG/KG	041M120201	1 / 2	2.00000 - 2.00000	1.3000	1.30	N/A	13000	310	N	N/A	BSL
7439896	Iron (Fe)	367.0000		484.0000		MG/KG	041M120101	2 / 2	NAV	425.50	484.00	N/A	N/A	N/A	N	N/A	EN
7439921	Lead (Pb)	5.1000		27.1000		MG/KG	041M120201	2 / 2	NAV	16.10	27.10	N/A	400	400	N	OSWER	BSL
7439954	Magnesium (Mg)	103.0000	J	468.0000	J	MG/KG	041M120101	2 / 2	NAV	285.50	468.00	N/A	N/A	N/A	N	N/A	EN
7439965	Manganese (Mn)	2.9000		7.6000		MG/KG	041M120201	2 / 2	NAV	5.25	7.60	N/A	15000	1100	N	N/A	BSL
75092	Methylene chloride	1.3000	J	1.3000	J	MG/KG	041M120201	1 / 2	1.90000 - 1.90000	1.3000	1.30	N/A	2900	85	C	N/A	BSL
91203	Naphthalene	1.3000		1.3000		MG/KG	041M120201	1 / 2	4.10000 - 4.10000	1.3000	1.30	N/A	13000	310	N	N/A	BSL
85018	Phenanthrene	2.5000		2.5000		MG/KG	041M120201	1 / 2	4.10000 - 4.10000	2.5000	2.50	N/A	9500	230	N	N/A	BSL
7440097	Potassium (K)	26.2000	J	138.0000		MG/KG	041M120101	2 / 2	NAV	82.10	138.00	N/A	N/A	N/A	N	N/A	EN
7782492	Selenium (Se)	0.4300	J	0.4300	J	MG/KG	041M120201	1 / 2	0.25 - 0.25	0.43	0.43	N/A	1600	39	N	N/A	BSL
7440235	Sodium (Na)	229.0000	J	1840.0000		MG/KG	041M120201	2 / 2	NAV	1034.50	1840.00	N/A	N/A	N/A	N	N/A	EN
7440622	Vanadium (V)	1.3000	J	6.6000		MG/KG	041M120101	2 / 2	NAV	3.95	6.60	N/A	2200	55	N	N/A	BSL
7440666	Zinc (Zn)	2.3000	J	3.0000		MG/KG	041M120101	2 / 2	NAV	2.65	3.00	N/A	95000	2300	N	N/A	BSL

- (1) Minimum/maximum detected concentration  
(2) Maximum concentration used as screening value.  
(3) Background values were not developed for this media.  
(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.  
(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1999).  
(6) Rationale Codes Selection Reason:  
Detection Reason:  
Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKGL)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable  
NAV = Not Available  
COPC = Chemical of Potential Concern  
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
OSWER = Office of Solid Waste and Emergency Response  
J = Estimated Value  
C = Carcinogenic  
N = Noncarcinogenic

TABLE 10-8-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 12 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
7440702	Calcium (Ca)	23000.000	0	23000.0000	0	UG/L	041W120101	1 / 1	NAV	23000.00	23000	N/A	N/A	N/A	N/A	NO	EN	
7440473	Chromium (Cr)	8.100	J	8.1000	J	UG/L	041W120101	1 / 1	NAV	8.10	8.1	N/A	360	11	N	N/A	NO	BSL
84742	Di-n-butylphthalate	1.000	J	1.0000	J	UG/L	041W120101	1 / 1	NAV	1.00	1	N/A	480	370	N	N/A	NO	BSL
7439896	Iron (Fe)	1150.000	0	1150.0000	0	UG/L	041W120101	1 / 1	NAV	1150.00	1150	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	1.200	J	1.2000	J	UG/L	041W120101	1 / 1	NAV	1.20	1.2	N/A	15	15	TTAL	NO	BSL	
7439954	Magnesium (Mg)	38400.000	0	38400.0000	0	UG/L	041W120101	1 / 1	NAV	38400.00	38400	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	47.900	0	47.9000	0	UG/L	041W120101	1 / 1	NAV	47.90	47.9	N/A	2400	73	N	N/A	NO	BSL
7440097	Potassium (K)	24100.000	0	24100.0000	0	UG/L	041W120101	1 / 1	NAV	24100.00	24100	N/A	N/A	N/A	N/A	NO	EN	
7440235	Sodium (Na)	541000.000	0	541000.0000	0	UG/L	041W120101	1 / 1	NAV	541000.00	541000	N/A	N/A	N/A	N/A	NO	EN	
7440280	Thallium (Tl)	12.200	0	12.2000	0	UG/L	041W120101	1 / 1	NAV	12.20	12.2	N/A	8.3	0.26	N	N/A	YES	ASL
7440666	Zinc (Zn)	7.800	J	7.8000	J	UG/L	041W120101	1 / 1	NAV	7.80	7.8	N/A	36000	1100	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 5 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1996).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.8.5.6 Risk Characterization**

As shown in Table 10-8-8, thallium is the only contributor to hazard index estimates for the surface water pathway under the adolescent trespasser scenario. The hazard index was estimated to be 0.15. As discussed in Section 8 a COC was considered to be a constituent that contributed to a pathway of concern that exceeded unity (one), as a result, thallium was not considered a COC.

#### **10.8.5.7 Remedial Goal Options**

No COCs were identified for Wetland 12, and as a result, no RGOs were calculated.

#### **10.8.6 Conclusions and Recommendations**

Because of the lack of ecological receptors at Wetland 12, no Phase IIB/III ecological risk appraisal was conducted at Wetland 12.

The HHRA found no sediment COPCs at Wetland 12. Thallium was considered a surface water COPC; however the hazard index was estimated to be 0.15, and thallium was therefore not considered a COC. No RGOs were therefore calculated for this wetland.

A concern at Wetland 12 is the 1991 spill from the adjacent bilge-water plant, in which petroleum-bilge water was spilled into this wetland. As documented in the September 19 and 20, 1996 Partnering Meeting Minutes, Wetland 12 is referred to the State of Florida's petroleum program.

TABLE 10-8-8  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 12  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Thallium	0.0122	MG/L	N/A	M	5.02E-06	mg/kg-day	7.00E-05	mg/kg-day	0.072
Dermal	Thallium	0.0122	MG/L		M	1.04E-06	mg/kg-day	1.40E-05	mg/kg-day	0.074
Total Hazard Index										0.15

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

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## **10.9 WETLAND 1**

### **10.9.1 Site Description**

Wetland 1 is north of Taylor Road, near Site 1, and southeast of Site 16. It is fed by surface water runoff from the Site 1 area. Portions of this wetland are depressions that are only saturated during the rainy season. A drainage ditch flows from the Wetland 1 area to the northwest, which eventually intersects with and drains into Wetland W2. This ditch is about 3 feet deep and has a maximum width of about 20 feet.

Parsons and Pruitt identified Wetland 1 as a palustrine, forested system which is dominated by slash pine (*Pinus elliotti*) (USEPA, 1991). Sediment in the wetland is variable in its TOC content, with levels up to 15%.

The IR sites potentially affecting Wetland 1 are Sites 1 and 16. Site 1 (Sanitary Landfill) was used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base. Site 16 (Brush Disposal Site) has been used for disposal of brush from pruning and tree trimming since the late 1960s (NEESA, 1983).

### **10.9.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-9-1 denotes Phase IIA Wetland 1 sampling locations.

#### **Sediment**

Twenty-one metals were detected in Wetland 1 sediment samples. Six of these — cadmium (1.2 ppm and 2 ppm at locations 0102 and 0104), chromium (57.7 ppm at location 0102), copper (22.3 ppm and 31.8 ppm at locations 0102 and 0104), lead (87.3 ppm, 48.8 ppm, and 153 ppm at locations 0101, 0103, and 0104), mercury (0.25 ppm, 0.17 ppm, and 0.20 ppm at locations 0102, 0103, and 0104), and zinc (294 ppm at location 0104) — exceeded sediment

benchmark levels. Nine pesticides were detected in Wetland 1 sediment samples, including 4,4'-DDT and its metabolites, alpha/gamma-chlordane, dieldrin, endosulfan sulfate, endrin aldehyde, and methoxychlor. 4,4'-DDT and its metabolites were below basewide levels (described in Section 6). Dieldrin exceeded its sediment benchmark level (0.72 ppb) at locations 0001 (3.7 ppb) and 0102 (6.9 ppb). Alpha-chlordane exceeded its sediment criteria (1.7 ppb) at locations 0102 (2.7 ppb) and 0104 (6.2 ppb). Gamma-chlordane also exceeded its sediment criteria (1.7 ppb) at locations 0102 (1.9 ppb), 0103 (3.3 ppb), and 0104 (9.5 ppb). The PCB Aroclor-1260 was also detected in Wetland 1 sediment samples. Two of three Aroclor-1260 detections (110 ppb/140 ppb at locations 0103/0104, respectively) exceeded its sediment benchmark criteria (21.6 ppb). Thirteen SVOCs were detected in Wetland 1 sediment samples, including 12 high- and low-molecular weight PAHs, and one phthalate ester. Several PAHs exceeded benchmark criteria at sample location 0103: benzo(a)anthracene (420 ppb), benzo(a)pyrene (480 ppb), chrysene (530 ppb), fluoranthene (1,200 ppb), phenanthrene (420 ppb), and pyrene (930 ppb). PAHs also exceeded benchmark levels at sample location 0104, including anthracene (990 ppb), benzo(a)anthracene (3,800 ppb), benzo(a)pyrene (4,300 ppb), chrysene (4,200 ppb), fluoranthene (7,200 ppb), phenanthrene (4,000 ppb), and pyrene (6,200 ppb). Bis(2-ethylhexyl)phthalate also exceeded its benchmark level (182 ppb) at locations 0102 (260 ppb), 0103 (680 ppb), and 0104 (3,500 ppb). Two VOCs detected were 2-butanone and acetone (a common laboratory contaminant).

Table 10-9-1 shows the Wetland 1 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-9-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only detected parameters with benchmark levels are presented in Table 10-9-2. The HQs will be further discussed in the ecological risk section (Section 10.9.4).

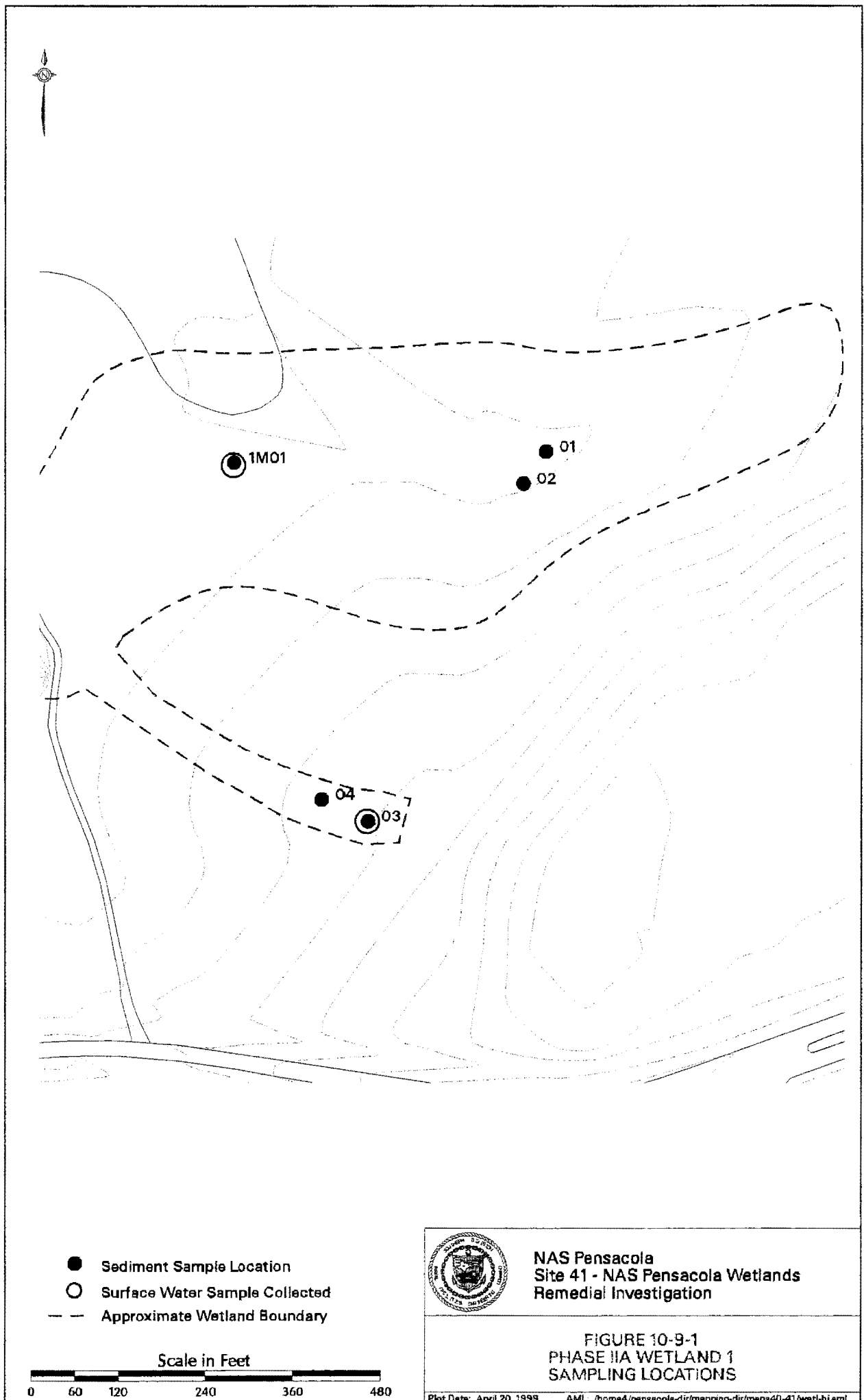




Table 10-9-1  
 Phase IIA Detected Concentrations in Wetland 1 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	5/5	1510 - 27800	8052
Antimony (Sb)	2/5	0.47 - 3.1	1.79
Arsenic (As)	4/5	0.4 - 2.5	1.46
Barium (Ba)	5/5	3.7 - 73.9	22.42
Beryllium (Be)	2/5	0.11 - 0.75	0.43
Cadmium (Cd)	3/5	0.53 - 2	1.24
Calcium (Ca)	5/5	327 - 2390	1054
Chromium (Cr)	5/5	1.5 - 57.7	20.82
Cobalt (Co)	3/5	0.4 - 1.8	1.06
Copper (Cu)	5/5	1.1 - 31.8	15.92
Iron (Fe)	5/5	484 - 6150	2564.8
Lead (Pb)	5/5	1.8 - 153	62.58
Magnesium (Mg)	5/5	75.9 - 621	244.18
Manganese (Mn)	5/5	3.7 - 17.8	9.44
Mercury (Hg)	4/5	0.07 - 0.25	0.17
Nickel (Ni)	4/5	0.8 - 8	5.05
Potassium (K)	4/5	28 - 309	114.55
Selenium (Se)	1/5	1.3	1.3
Sodium (Na)	3/5	33 - 204	111.33
Vanadium (V)	5/5	2.3 - 35.3	10.98
Zinc (Zn)	5/5	2.2 - 294	93.34
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	4/5	3.1 - 25	10.25
4,4'-DDE	4/5	0.48 - 8.6	4.85
4,4'-DDT	4/5	1.1 - 10	3.43
alpha-Chlordane	3/5	1.1 - 6.2	3.33
Aroclor 1260	3/5	7.7 - 140	85.9

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-9-1  
 Phase IIA Detected Concentrations in Wetland 1 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Pesticides and PCBs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Dieldrin	2/5	3.7 - 6.9	5.3
Endosulfan sulfate	2/5	0.45 - 1.6	1.03
Endrin aldehyde	1/5	1.5	1.5
gamma-Chlordane	3/5	1.9 - 9.5	4.9
Methoxychlor	1/5	6.6	6.6
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Anthracene	1/5	990	990
Benzo(a)anthracene	2/5	420 - 3800	2110
Benzo(a)pyrene	2/5	480 - 4300	2390
Benzo(b)fluoranthene	2/5	600 - 5400	3000
Benzo(g,h,i)perylene	2/5	250 - 1900	1075
Benzo(k)fluoranthene	2/5	220 - 1700	960
bis(2-Ethylhexyl)phthalate (BEHP)	4/5	41 - 3500	1120.25
Carbazole	1/5	880	880
Chrysene	2/5	530 - 4200	2365
Fluoranthene	2/5	1200 - 7200	4200
Indeno(1,2,3-cd)pyrene	2/5	220 - 2000	1110
Phenanthrene	2/5	420 - 4000	2210
Pyrene	2/5	930 - 6200	3565
<b>VOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
2-Butanone (MEK)	1/5	110	110
Acetone	1/5	250	250

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

**Table 10-9-2**  
**Wetland 1**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
041M010101					
	Arsenic (MG/KG)	2.5	7.24	0.35	a b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	41 J	182	0.23	b
	Chromium (MG/KG)	1.5	52.3	0.03	a b
	Copper (MG/KG)	1.1 J	18.7	0.06	a b
	Lead (MG/KG)	87.3	30.2	2.89	a b
	Mercury (MG/KG)	0.07 J	0.13	0.54	a b
	Nickel (MG/KG)	0.8 J	15.9	0.05	a b
	Zinc (MG/KG)	2.8	174	0.03	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-9-2  
Wetland 1  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M010301</b>					
	4,4'-DDD (UG/KG)	5 DJ	1.22	4.10	b
	4,4'-DDE (UG/KG)	0.48 J	2.07	0.23	b
	4,4'-DDT (UG/KG)	1.4 J	1.19	1.18	b
	alpha-Chlordane (UG/KG)	1.1 J	1.7	0.65	a
	Aroclor-1260 (UG/KG)	110 DJ	21.6	5.09	b
	Arsenic (MG/KG)	0.4 J	7.24	0.06	a b
	Benzo(a)anthracene (UG/KG)	420 J	74.8	5.61	b
	Benzo(a)pyrene (UG/KG)	480	88.8	5.41	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	680 J	182	3.74	b
	Cadmium (MG/KG)	0.53	0.68	0.78	b
	Chromium (MG/KG)	9.8	52.3	0.19	a b
	Chrysene (UG/KG)	530	108	4.91	b
	Copper (MG/KG)	18.3	18.7	0.98	a b
	Endrin aldehyde (UG/KG)	1.5 J	3.3	0.45	a
	Fluoranthene (UG/KG)	1200	113	10.62	b
	gamma-Chlordane (UG/KG)	3.3 DJ	1.7	1.94	a
	Lead (MG/KG)	48.8	30.2	1.62	a b
	Mercury (MG/KG)	0.17	0.13	1.31	a b
	Nickel (MG/KG)	3.9	15.9	0.25	a b
	Phenanthrene (UG/KG)	420 J	86.7	4.84	b
	Pyrene (UG/KG)	930	153	6.08	b
	Zinc (MG/KG)	69.1	124	0.56	a b
<b>041M010401</b>					
	4,4'-DDD (UG/KG)	25 DJ	1.22	20.49	b
	4,4'-DDE (UG/KG)	4.5 DJ	2.07	2.17	b
	4,4'-DDT (UG/KG)	10 DJ	1.19	8.40	b
	alpha-Chlordane (UG/KG)	6.2 DJ	1.7	3.65	a
	Anthracene (UG/KG)	990 J	46.9	21.11	b
	Antimony (MG/KG)	0.47 J	12	0.04	a
	Aroclor-1260 (UG/KG)	140 DJ	21.6	6.48	b
	Arsenic (MG/KG)	2.5	7.24	0.35	a b
	Benzo(a)anthracene (UG/KG)	3800	74.8	50.80	b
	Benzo(a)pyrene (UG/KG)	4300	88.8	48.42	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	3500 J	182	19.23	b
	Cadmium (MG/KG)	2	0.68	2.94	b
	Chromium (MG/KG)	27.3	52.3	0.52	a b
	Chrysene (UG/KG)	4200	108	38.89	b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

**Table 10-9-2**  
**Wetland 1**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	Copper (MG/KG)	31.8	18.7	1.70	a b
	Fluoranthene (UG/KG)	7200	113	63.72	b
	gamma-Chlordane (UG/KG)	9.5 DJ	1.7	5.59	a
	Lead (MG/KG)	153	30.2	5.07	a b
	Mercury (MG/KG)	0.2	0.13	1.54	a b
	Nickel (MG/KG)	7.5	15.9	0.47	a b
	Phenanthrene (UG/KG)	4000	86.7	46.14	b
	Pyrene (UG/KG)	6200	153	40.52	b
	Zinc (MG/KG)	294	124	2.37	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

## Surface Water

Fourteen metals were detected in Wetland 1 surface water samples. Aluminum (2,120 ppb), chromium (13.5 ppb), iron (3,540 ppb), and lead (6 ppb) exceeded their water quality criteria at location 1W01. No pesticides, PCBs, or SVOCs were detected in Wetland 1 surface water. The only VOC detected was 2-butanone. No surface water quality criteria exists for 2-butanone.


Table 10-9-3 shows the Wetland 1 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-9-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only parameters with water quality criteria are presented in Table 10-9-4. The HQs will be further discussed ecological risk section (Section 10.9.4).

Table 10-9-3  
 Phase IIA Detected Concentrations in Wetland 1 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/2	2120	2120
Arsenic (As)	1/2	3.4	3.4
Barium (Ba)	2/2	10.8 - 32.1	21.45
Calcium (Ca)	2/2	11700 - 30700	21200
Chromium (Cr)	1/2	13.5	13.5
Copper (Cu)	1/2	7.5	7.5
Iron (Fe)	2/2	302 - 3540	1921
Lead (Pb)	1/2	6	6
Magnesium (Mg)	2/2	2140 - 2560	2350
Manganese (Mn)	2/2	17.4-143	80.2
Potassium (K)	2/2	1040 - 2300	1670
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Sodium (Na)	2/2	5510 - 7370	6440
Vanadium (V)	1/2	10.2	10.2
Zinc (Zn)	2/2	19.3 - 39.7	29.5
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
2-Butanone (MEK)	1/2	2	2

Note:  
 All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

**Table 10-9-4 (1)**  
**Wetland 1**  
**Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UDM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
						
041W010301	Freshwater					
Iron		UG/L	302.0	1,000.0	0.302	a b
Zinc		UG/L	19.3	70.2	0.27483	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### 10.9.3 Fate and Transport

Pathways evaluated for wetland-specific fate and transport correlate with those identified in the conceptual model presented in Section 9: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Because sediment transport and storm water runoff data are lacking, the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-9-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Detected contaminants present in surface water above water quality criteria are presented in Table 10-9-4.

### Transport into the Wetland

#### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 1 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 1 and 16. Wetland 1 also has a direct connection with Wetland W2, which can be tidally influenced.

Table 10-9-5  
 Calculated Sediment Screening Values for Wetland 1

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Inorganics	(ppb)		(ppm)	(ppm)	
Cadmium	0.774 <sup>a, b</sup>	7.5E+01	5.82	2 <sub>H</sub>	NO
Chromium	11 <sup>a, b</sup>	1.9E+01	21.04	57.7	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	335.5	31.8	NO
Lead	1.71 <sup>a, b</sup>	9E+02	153.9	153	NO
Mercury	0.012 <sup>a, b</sup>	5.2E+01	0.063	0.25	YES
Zinc	70.2 <sup>a, b</sup>	6.2E+01	436.17	294	NO



Table 10-9-5  
Calculated Sediment Screening Values for Wetland 1

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)		(ppb)	(ppb)	
4,4'-DDE	10.5 <sup>a</sup>	2.41E+05	2.53E+08	8.6	NO
4,4'-DDD	0.0064 <sup>a</sup>	5.4E+04	3.46E+02	25	NO
4,4'-DDT	0.001 <sup>a, b</sup>	1.42E+05	1.42E+04	10	NO
Dieldrin	0.0019 <sup>a, b</sup>	1.16E+03	220.15	6.9	NO
Anthracene	110,000 <sup>b</sup>	1.59E+03	1.75E+10	990	NO
Total PCBs*	0.014 <sup>a, b</sup>	1.67E+04	2.34E+04	140	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	2.15E+04	6.65E+04	3,800	NO
Benzo(a)pyrene	0.031 <sup>b</sup>	5.52E+04	1.71E+05	4,300	NO
Chlordane (alpha and gamma)	0.004 <sup>a, b</sup>	6.48E+3	2.59E+03	6.2	NO
Chrysene	0.031 <sup>b</sup>	2.15E+04	6.65E+04	4,200	NO
Fluoranthene	39.8 <sup>a</sup>	5.78E+03	2.3E+04	7,200	NO
Phenanthrene	0.031 <sup>b</sup>	1.63E+03	5053	4,000	NO
Pyrene	11,000 <sup>b</sup>	5.65E+03	6.22E+09	6,2000	NO
Bis(2-ethylhexyl)phthalate	0.3 <sup>a</sup>	8.16E+05	2.45E+08	3,500	NO

**Notes:**

Kd for organics calculated using foc of 0.054 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix(USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

\* = based on Aroclor-1260.

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

The presence of sediment contaminants above benchmark screening levels (see Table 10-9-5) validates the sediment transport pathway and by inference the surface water pathway. Additionally, there were three inorganics present in surface water above water quality criteria, further validating the pathway.

#### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential sources that would directly contribute contamination to Wetland 1 through this pathway are Sites 1 and 16, and potentially further upgradient Sites 7, 17, and UST 26 (a jet fuel tank of unknown size/quantity). Groundwater at Site 1 has been shown to be contaminated, therefore the pathway is considered valid.

#### **Transport within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that the surface water and sediment transport will occur to the west to Wetland W2, and from there to Bayou Redoubt. During periods of very high tides or storm surges some back flushing of surface water will occur within Wetland W2, and potentially affect Wetland 1. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

##### *Sediment Leaching to Surface Water Pathway*

Six organics — four pesticides, PCBs, and eight semivolatiles — and thirteen inorganics exceeded their benchmark screening level (see Table 10-9-5), but only two — chromium and mercury — exceeded its calculated SSL (see Table 10-9-5). Mercury was not present in the corresponding surface water samples, however, indicating a low potential for this pathway for this constituent. Chromium was present in the corresponding surface water, suggesting a high potential for this pathway with respect to this parameter. In surface water, aluminum, chromium, copper, lead, and iron were present above water quality criteria; these are attributable to the surface water/groundwater discharge pathway. Because mercury and chromium were detected in sediment above their SSLs, the pathway is considered valid, and the presence of chromium above standards in surface water suggests the pathway may also be significant.

### **Transport from the Wetland**

Transport of surface water and sediment from Wetland 1 can be expected to occur towards the west into Wetland W2 and eventually into Bayou Redoubt. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

### **10.9.4 Ecological Risk Assessment**

HQs for Wetland 1 sediment samples are presented in Table 10-9-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for cadmium (1.76 and 2.94 at locations 0102 and 0104), chromium (1.10 at location 0102), copper (1.19 and 1.70 at locations 0102 and 0104), lead (2.89, 1.62, and 5.07 at locations 0101, 0103, and 0104), mercury (1.92, 1.31, and 1.54 at locations 0102, 0103, and 0104), and zinc (2.37 at location 0104). 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT had HQs greater than 1 at location 0001 (2.54, 2.80, and 1.01), and location 0104 (20.49, 2.17, and 8.40). 4,4'-DDD, and 4,4'-DDE had HQs greater than 1 at location 0102 (6.48 and 4.15), while 4,4'-DDD and DDT had HQs above 1 at location 0103 (4.10 and 1.18). As noted in the Nature and Extent discussion, the concentrations of 4,4'-DDT and its metabolites were below basewide levels. Dieldrin had a HQ greater than 1 at locations 0001 (5.14) and 0102 (9.58). Alpha-chlordane had a HQ greater than 1 at locations 0102 (1.59) and 0104 (3.65). The HQ for gamma-chlordane was above 1 at locations 0102 (1.12), 0103 (1.94), and 0104 (5.59). Two of three Aroclor-1260 detections (5.09/6.48 at locations 0103/0104, respectively) had HQs above 1. Several PAHs had HQs greater than 1 at sample location 0103: benzo(a)anthracene (5.61), benzo(a)pyrene (5.41), chrysene (4.91), fluoranthene (10.62), phenanthrene (4.84), and pyrene (6.08). HQs were also greater than 1 for PAHs at sample location 0104, including anthracene (21.1), benzo(a)anthracene (50.80), benzo(a)pyrene (48.42), chrysene (38.89), fluoranthene (63.72), phenanthrene (46.14), and pyrene (40.52). Bis(2-ethylhexyl)phthalate also had a HQ above 1 at locations 0102 (1.43), 0103 (3.74), and 0104 (19.23). Phase IIA surface water results revealed HQs greater than 1 for aluminum (24.37), chromium (1.23), iron (3.54), and lead (3.51). HQs greater than 1 indicate a potential for excess risk.

Wetland 1 was classified in Group D (all wetlands in this group appear as man-made drainage ditches and have limited ecological receptors) and was not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

### **10.9.5 Human Health Risk Assessment**

#### **10.9.5.1 Samples Included**

##### **Sediment**

001M000101, 041M010101, 041M010201, 041M010301, 041M010401

##### **Surface Water**

001W000101, 041W010301

#### **10.9.5.2 Current and Future Land Use**

Wetland 1 is within the Site 1 landfill area, and is cordoned off from the public. Access roads are restricted by locked gates, and signs warn trespassers away from the area. Though a nature trail does traverse the northern part of Site 1, a thickly wooded zone would have to be crossed to access the Wetland 1 area. Future land use of Site 1 is speculative, and may include expansion of the A.C. Read Golf Course or the cemetery near Wetland 1. However, in accordance with the Land Use Control Agreement, intrusive activities are not permitted in Site 1 without approval from the NAS Pensacola Environmental Office (EnSafe, 1998).

#### **10.9.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.9.5.4 Sediment COPCs**

As shown in Table 10-9-6, the following sediment COPC was identified:

- Benzo(a)pyrene

#### **10.9.5.5 Surface Water COPCs**

As shown in Table 10-9-7, no surface water COPCs were identified:

#### **10.9.5.6 Risk Characterization**

##### *Exposure Point Concentrations*

The risk associated with exposure to benzo(a)pyrene concentrations in sediment was evaluated by calculating the benzo(a)pyrene equivalent concentration using TEFs provided by USEPA Region 4 (see Section 8 of this report). The exposure point concentration used to evaluate risk for Wetland 1 sediment was calculated by adding all of the TEF adjusted maximum reported concentrations for the seven carcinogenic PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene). The sediment sample reporting the maximum carcinogenic PAHs was 041M010401. The resulting EPC was calculated to be 5.99 mg/kg for benzo(a)pyrene equivalents.

##### *Adolescent Trespasser*

As shown in Table 10-9-8, benzo(a)pyrene equivalents were the only contributor to risk estimates for the sediment pathways under the adolescent trespasser scenario. The cumulative risk estimated for this wetland is 2.1E-6. As a result, benzo(a)pyrene equivalents were identified as COCs for sediment based on contribution to the cumulative risk estimate for this wetland.

#### **10.9.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Benzo(a)pyrene equivalents were identified as COCs for sediment at Wetland 1. Because benzo(a)pyrene equivalents were identified as COCs for sediment based on cancer risk estimates, only risk based RGOs were developed.

TABLE 10-9-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Exposure Medium: Current and Future  
Medium: Soil  
Exposure Medium: Sediment  
Exposure Point: Western 1 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	(2) Background Value	(3) Adolescent Site Trespasser PRG	(4) Residential Soil RBC	(5) Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
78933	2-Butanone (MEK)	0.1100	J	0.1100	J	MG/KG	041M010201	1 / 5	0.013 - 0.020	0.110	0.11	N/A	190000	4700	N	N/A	NO	BSL
72548	4,4'-DDD	0.0031	J	0.0250	DJ	MG/KG	041M010101	4 / 5	0.00023 - 0.00023	0.010	0.03	N/A	92	2.7	C	N/A	NO	BSL
72559	4,4'-DDE	0.0005	J	0.0086	J	MG/KG	041M010201	4 / 5	0.00023 - 0.00023	0.005	0.01	N/A	65	1.9	C	N/A	NO	BSL
50283	4,4'-DDT	0.0011	J	0.0100	J	MG/KG	041M010401	4 / 5	0.00023 - 0.00023	0.003	0.01	N/A	65	1.9	C	N/A	NO	BSL
67641	Acetone	0.2500	J	0.2500	J	MG/KG	041M010201	1 / 5	0.014 - 0.072	0.250	0.25	N/A	320000	780	N	N/A	NO	BSL
120127	Anthracene	0.9900	J	0.9900	J	MG/KG	041M010401	1 / 5	0.045 - 0.640	0.990	0.99	N/A	95000	2300	N	N/A	NO	BSL
7440360	Antimony (Sb)	0.4700	J	3.1000	J	MG/KG	041M010101	2 / 5	0.14 - 12.90	1.79	3.10	N/A	130	3.1	N	N/A	NO	BSL
11096825	Aroclor-1260	0.0077	J	0.1400	J	MG/KG	041M010401	3 / 5	0.002 - 0.064	0.086	0.14	N/A	11	0.32	C	N/A	NO	BSL
7440382	Arsenic (As)	0.4000	J	2.5000	J	MG/KG	041M010301	4 / 5	1.20 - 1.20	1.46	2.50	N/A	15	0.43	C	N/A	NO	BSL
56553	Benzo(a)anthracene	0.4200	J	3.8000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	2.110	3.80	N/A	30	0.88	C	N/A	NO	BSL
50328	Benzo(a)pyrene	0.4800	J	4.3000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	2.390	4.30	N/A	3	0.088	C	N/A	YES	ASL
205992	Benzo(b)fluoranthene	0.6000	J	5.4000	DJ	MG/KG	041M010301	2 / 5	0.045 - 0.640	3.000	5.40	N/A	30	0.88	C	N/A	NO	BSL
191242	Benzo(g,h,i)perylene	0.2500	J	1.9000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	1.075	1.90	N/A	300000	230	N	N/A	NO	BSL
207089	Benzo(k)fluoranthene	0.2200	J	1.7000	DJ	MG/KG	041M010301	2 / 5	0.045 - 0.640	0.960	1.70	N/A	300	8.8	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.1100	J	0.7500	DJ	MG/KG	041M010401	2 / 5	0.07 - 0.47	0.43	0.75	N/A	630	18	C	N/A	NO	BSL
7440439	Cadmium (Cd)	0.5300	J	2.0000	J	MG/KG	041M010201	3 / 5	0.15 - 1.50	1.24	2.00	N/A	320	7.8	N	N/A	NO	BSL
86748	Carbazole	0.8800	J	0.8800	J	MG/KG	041M010401	1 / 5	0.450 - 4.200	0.880	0.88	N/A	1100	3.2	C	N/A	NO	BSL
218019	Chrysene	0.5300	J	4.2000	J	MG/KG	041M010401	2 / 5	0.045 - 0.640	2.365	4.20	N/A	3000	88	C	N/A	NO	BSL
7440484	Cobalt (Co)	0.4000	J	1.8000	J	MG/KG	041M010301	3 / 5	0.15 - 1.80	1.06	1.80	N/A	19000	470	N	N/A	NO	BSL
80571	Dieldrin	0.0037	J	0.0069	DJ	MG/KG	041M010301	2 / 5	0.00021 - 0.00027	0.005	0.01	N/A	1.4	0.04	C	N/A	NO	BSL
1031078	Endosulfan sulfate	0.0005	J	0.0016	DJ	MG/KG	041M010101	2 / 5	0.00023 - 0.0064	0.001	0.0018	N/A	1900	47	N	N/A	NO	BSL
7421934	Endrin aldehyde	0.0015	J	0.0015	J	MG/KG	041M010201	1 / 5	0.00023 - 0.0064	0.002	0.0015	N/A	95	2.3	N	N/A	NO	BSL
206440	Fluoranthene	1.2000	J	7.2000	J	MG/KG	041M010401	2 / 5	0.045 - 0.640	4.200	7.20	N/A	13000	310	N	N/A	NO	BSL
193395	Indeno(1,2,3-cd)pyrene	0.2200	J	2.0000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	1.110	2.00	N/A	30	0.88	C	N/A	NO	BSL
7440020	Nickel (Ni)	0.8000	J	8.0000	J	MG/KG	041M010201	4 / 5	17.10 - 17.10	0.17	8.00	N/A	6300	160	N	N/A	NO	BSL
85018	Phenanthrene	0.4200	J	4.0000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	0.007	4.00	N/A	9500	230	N	N/A	NO	BSL
7440097	Potassium (K)	28.0000	J	309.0000	J	MG/KG	041M010301	4 / 5	1090.00 - 1090.00	5.05	309.00	N/A	N/A	N/A	N	N/A	NO	EN
129000	Pyrene	0.9300	J	8.2000	J	MG/KG	041M010301	2 / 5	0.045 - 0.640	2.210	8.20	N/A	9500	230	N	N/A	NO	BSL
7782492	Selenium (Se)	1.3000	J	1.3000	J	MG/KG	041M010101	1 / 5	0.27 - 1.70	114.55	1.30	N/A	1800	39	N	N/A	NO	BSL
7440235	Sodium (Na)	33.0000	J	204.0000	J	MG/KG	041M010401	3 / 5	18.00 - 17.50	3565.00	204.00	N/A	N/A	N/A	N	N/A	NO	EN
5103719	alpha-Chlordane	0.0011	J	0.0062	J	MG/KG	041M010301	3 / 5	0.00011 - 0.003	0.001	0.01	N/A	63	1.8	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	0.0410	J	3.5000	J	MG/KG	041M010101	4 / 5	0.840 - 0.640	0.111	3.50	N/A	1600	46	C	N/A	NO	BSL
5103742	gamma-Chlordane	1.9000	J	9.5000	J	MG/KG	041M010301	3 / 5	0.00011 - 0.003	0.003	9.50	N/A	63	1.8	C	N/A	NO	BSL
7429605	Aluminum (Al)	1510.0000	J	27800.0000	J	MG/KG	041M010101	5 / 5	NAV	8052.00	27800.00	N/A	320000	7800	N	N/A	NO	BSL
7440393	Barium (Ba)	3.7000	J	73.9000	J	MG/KG	041M010101	5 / 5	NAV	22.42	73.90	N/A	22000	550	N	N/A	NO	BSL
7440702	Calcium (Ca)	327.0000	J	2380.0000	J	MG/KG	041M010401	5 / 5	NAV	1054.00	2380.00	N/A	N/A	N/A	N	N/A	NO	EN
7440473	Chromium (Cr)	1.5000	J	57.7000	J	MG/KG	041M010201	5 / 5	NAV	20.82	57.70	N/A	1800	23	N	N/A	NO	BSL
7440508	Copper (Cu)	1.1000	J	31.8000	J	MG/KG	041M010401	5 / 5	NAV	15.92	31.80	N/A	13000	310	N	N/A	NO	BSL
7439899	Iron (Fe)	484.0000	J	6150.0000	J	MG/KG	041M010401	5 / 5	NAV	2584.80	6150.00	N/A	N/A	N/A	N	N/A	NO	EN
7439921	Lead (Pb)	1.8000	J	153.0000	J	MG/KG	041M010401	5 / 5	NAV	82.58	153.00	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	75.8000	J	621.0000	J	MG/KG	041M010301	5 / 5	NAV	244.18	621.00	N/A	N/A	N/A	N	N/A	NO	EN
7439965	Manganese (Mn)	3.7000	J	17.8000	J	MG/KG	001M000101	5 / 5	NAV	9.44	17.80	N/A	15000	1100	N	N/A	NO	BSL
7440622	Vanadium (V)	2.3000	J	35.3000	J	MG/KG	001M000101	5 / 5	NAV	10.98	35.30	N/A	2200	55	N	N/A	NO	BSL
7440668	Zinc (Zn)	2.2000	J	284.0000	J	MG/KG	001M000101	5 / 5	NAV	93.34	284.00	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value

(3) Background values were not developed for this media

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998)

(6) Rationale Codes Selection Reason:

Deletion Reason:

Above Screening Levels (ASL)

Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-9-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 1 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limit	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
78933	2-Butanone (MEK)	2.000	J	2.0000		UG/L	041W010301	1 / 2	NAV	2.00	2	N/A	110000	190	N	N/A	NO	BSL
7429905	Aluminum (Al)	2120.000	0	2120.0000		UG/L	001W000101	1 / 2	NAV	2120.00	2120	N/A	120000	3700	N	N/A	NO	BSL
7440382	Arsenic (As)	3.400	0	3.4000		UG/L	001W000101	1 / 2	NAV	3.40	3.4	N/A	5.6	0.045	C	N/A	NO	BSL
7440393	Barium (Ba)	10.800	J	32.1000		UG/L	001W000101	2 / 2	NAV	21.45	32.1	N/A	8300	260	N	N/A	NO	BSL
7440702	Calcium (Ca)	11700.000		30700.0000		UG/L	041W010301	2 / 2	NAV	21200.00	30700	N/A	N/A	N/A		N/A	NO	EN
7440473	Chromium (Cr)	13.500		13.5000		UG/L	001W000101	1 / 2	NAV	13.50	13.5	N/A	360	11	N	N/A	NO	BSL
7440508	Copper (Cu)	7.500		7.5000		UG/L	001W000101	1 / 2	NAV	7.50	7.5	N/A	4800	150	N	N/A	NO	BSL
7439896	Iron (Fe)	302.000		3540.0000		UG/L	001W000101	2 / 2	NAV	1921.00	3540	N/A	N/A	N/A		N/A	NO	EN
7439921	Lead (Pb)	6.000	J	6.0000		UG/L	001W000101	1 / 2	NAV	6.00	6	N/A	15	15		TTAL	NO	BSL
7439954	Magnesium (Mg)	2140.000	0	2560.0000	J	UG/L	041W010301	2 / 2	NAV	2350.00	2560	N/A	N/A	N/A		N/A	NO	EN
7439965	Manganese (Mn)	17.400	0	143.0000		UG/L	001W000101	2 / 2	NAV	80.20	143	N/A	2400	73	N	N/A	NO	BSL
7440097	Potassium (K)	1040.000	0	2300.0000	J	UG/L	041W010301	2 / 2	NAV	1670.00	2300	N/A	N/A	N/A		N/A	NO	EN
7440235	Sodium (Na)	5510.000	0	7370.0000		UG/L	041W010301	2 / 2	NAV	6440.00	7370	N/A	N/A	N/A		N/A	NO	EN
7440622	Vanadium (V)	10.200		10.2000		UG/L	001W000101	1 / 2	NAV	10.20	10.2	N/A	830	26	N	N/A	NO	BSL
7440666	Zinc (Zn)	19.300	J	39.7000		UG/L	001W000101	2 / 2	NAV	29.50	39.7	N/A	36000	1100	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-9-8  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 1  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)pyrene equivalents	5.99	MG/KG	N/A	M	2.71E-07	mg/kg-day	7.3	(mg/kg-day) <sup>-1</sup>	1.98E-06
Dermal	Benzo(a)pyrene equivalents	5.99	MG/KG	N/A	M	1.11E-08	mg/kg-day	14.6	(mg/kg-day) <sup>-1</sup>	1.62E-07
Total Risk All Exposure Routes/Pathways										2.14E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



## **10.10 WETLAND 15**

### **10.10.1 Site Description**

Wetland 15 is on the shore of Bayou Grande, between Wetland 4D and the NAS Pensacola picnic grounds. This wetland is bordered by the A.C. Read golf course to the south, east, and west.

Parsons and Pruitt (USEPA, 1991) described this area as an estuarine emergent system, predominantly containing black needlerush (*Juncus roemerianus*). The vegetation surrounding Wetland 15 includes shrubs such as wax myrtle (*Myrica cerifera*). Surface water runoff from the golf course discharges from Wetland 15 into Bayou Grande through a drainage channel about 3 feet wide. The wetland is tidally influenced from Bayou Grande through the same channel. The open water portion of the wetland ranges from one to about three feet in depth and has a maximum width of about 150 feet. Sediment in the wetland is highly organic, with TOC detected at up to 40%.

The IR site potentially affecting Wetland 15 is Site 1. Site 1 (Sanitary Landfill) was used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base (NEESA, 1983). Although located at the northernmost tip of Site 1, watershed analysis performed at NAS Pensacola using GPS data revealed that this wetland is not suspected of being impacted by this site.

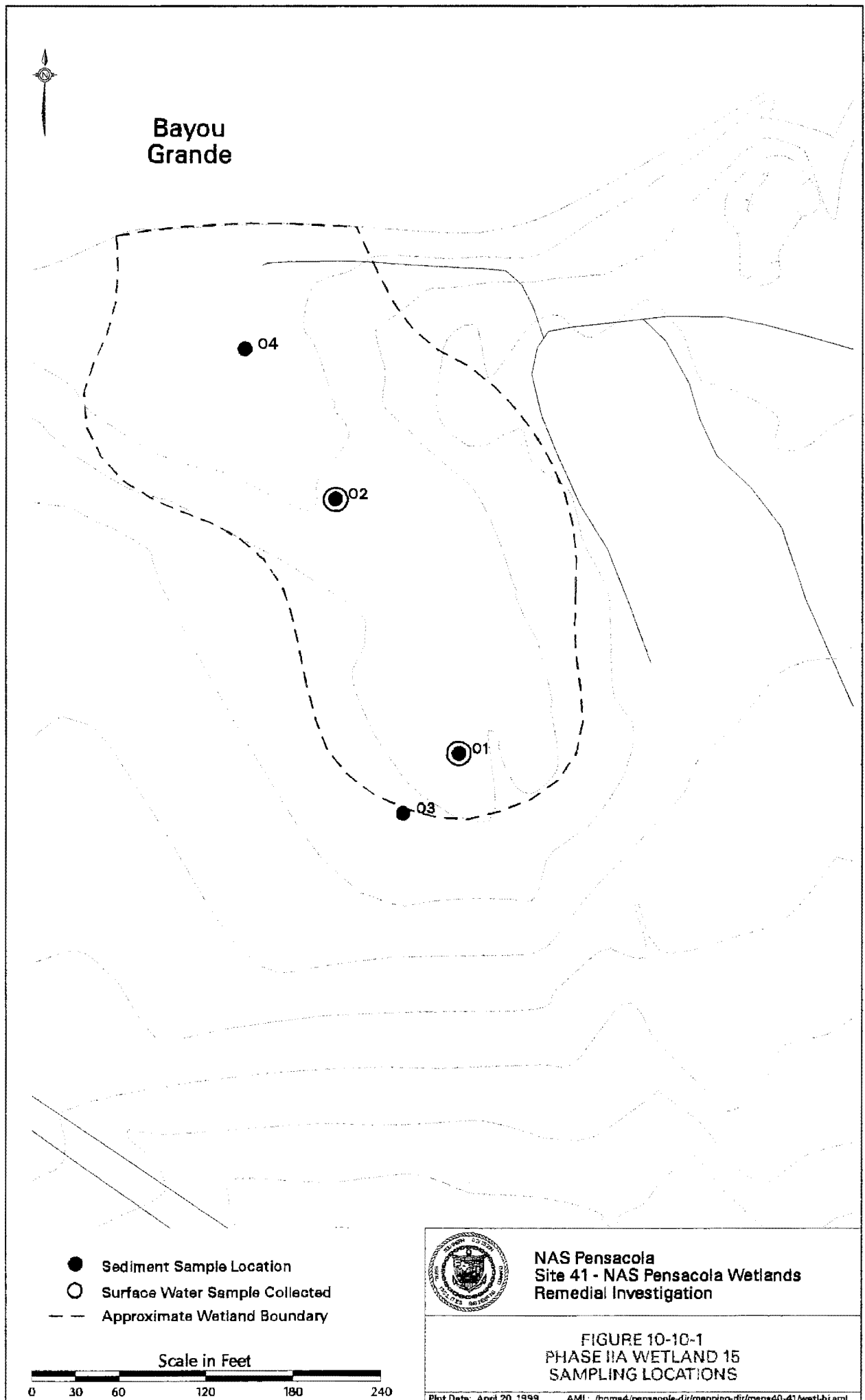
### **10.10.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-10-1 denotes Phase IIA Wetland 15 sampling locations.

## **Sediment**

Nineteen metals were detected in Wetland 15 sediment samples. Three metals, including arsenic (15.2 ppm and 141 ppm at locations 1502 and 1503), copper (20.2 ppm and 18.9 ppm at locations 1502 and 1503), and lead (39.7 ppm, 211 ppm, and 174 ppm at locations 1501, 1502, and 1503) exceeded sediment benchmark levels at Wetland 15. Eleven pesticides were detected in Wetland 15 sediment samples, including 4,4'-DDT and its metabolites, beta/delta-BHC, endosulfan I, endrin, endrin aldehyde, endrin ketone, heptachlor, and alpha-chlordane. 4,4'-DDD/DDE, each exceeded basewide levels and sediment benchmark values at locations 1501 (85 ppb/340 ppb), 1502 (62 ppb/110 ppb), and 1503 (200 ppb/69 ppb). Basewide levels are discussed in Section 6. 4,4'-DDD/DDE exceeded sediment benchmark values but were below basewide levels at location 1504 (1.3 ppb/10 ppb). 4,4'-DDT exceeded sediment benchmark values but was below basewide levels at locations 1501 (9.9 ppb), 1502 (4.3 ppb), and 1503 (16 ppb). Endrin exceeded its sediment screening level (3.3 ppb) at location 1502 (16 ppb). Endrin aldehyde exceeded its sediment screening level (3.3 ppb) at location 1501 (7.3 ppb). The PCB Aroclor-1260 was also detected, exceeding the sediment screening level (21.6 ppb) at locations 1502 (24 ppb) and 1503 (32 ppb). Eleven SVOCs were detected in Wetland 15 sediment samples. Two PAHs exceeded sediment benchmark levels, including fluoranthene (200 ppb, 240 ppb, and 190 ppb at locations 1501, 1502, and 1503) and pyrene (210 ppb and 180 ppb at locations 1502 and 1503). Bis(2-ethylhexyl)phthalate was detected above its screening level (182 ppb) at locations 1501 (230 ppb), 1502 (490 ppb), and 1504 (220 ppb). Three VOCs, including 2-butanone, acetone, and methylene chloride were also detected in Wetland 15 sediments but were below sediment benchmark values. Acetone and methylene chloride are common laboratory contaminants.

Table 10-10-1 shows the Wetland 15 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-10-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.13.4). Only the parameters with benchmark levels are presented in Table 10-13-2.



**Table 10-10-1**  
**Phase IIA Detected Concentrations in Wetland 15 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	4/4	7810 - 15800	10235
Antimony (Sb)	1/4	6	6
Arsenic (As)	4/4	2.5 - 141	40.88
Barium (Ba)	4/4	6.2 - 40.9	25.9
Beryllium (Be)	1/4	0.34	0.34
Calcium (Ca)	4/4	3010 - 11300	7205
Chromium (Cr)	4/4	14.3 - 45.7	29.63
Cobalt (Co)	1/4	1.5	1.5
Copper (Cu)	4/4	5.5 - 20.2	13.28
Iron (Fe)	4/4	11200 - 22300	70975
Lead (Pb)	4/4	20.7 - 211	111.35
Magnesium (Mg)	4/4	912 - 4980	2575
Manganese (Mn)	4/4	47.7 - 520	204.65
Nickel (Ni)	2/4	5.6 - 12.4	9
Potassium (K)	4/4	310 - 1460	807.75
Selenium (Se)	3/4	0.93 - 2.7	1.74
Sodium (Na)	4/4	206 - 1420	6526.5
Vanadium (V)	4/4	10.5 - 36	21.65
Zinc (Zn)	4/4	23.5 - 83.6	48.33
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	4/4	13 - 200	87.08
4,4'-DDT	3/4	4.3 - 16	10.07
4,4'-DDE	4/4	10 - 340	132.25
alpha-Chlordane	1/4	1.4	1.4
Aroclor-1260	3/4	14 - 32	23.33
beta-BHC	2/4	0.94 - 1.4	1.17
delta-BHC	1/4	5.5	5.5
Endosulfan I	1/4	1.7	1.7
Endrin ketone	1/4	1.9	1.9
Endrin aldehyde	2/4	1.3 - 7.3	4.3
Endrin	3/4	1.5 - 16	6.67
Heptachlor	1/4	1.1	1.1

Table 10-10-1  
 Phase IIA Detected Concentrations in Wetland 15 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Methylphenol (o-Cresol)	1/4	330	330
2,2'-oxybis(1-Chloropropane)	1/4	82	82
2,4-Dimethylphenol	1/4	630	630
4-Methylphenol (p-Cresol)	1/4	4800	4800
Benzo(a)pyrene	1/4	59	59
Benzo(b)fluoranthene	3/4	79 - 250	176.33
bis(2-Ethylhexyl)phthalate (BEHP)	3/4	220 - 490	313.33
Di-n-butylphthalate	3/4	130 - 250	190
Fluoranthene	4/4	94 - 240	181
Phenol	1/4	280	280
Pyrene	3/4	120 - 210	170
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Butanone (MEK)	1/3	350	350
Acetone	2/3	130 - 1400	765
Methylene chloride	1/3	34	34

**Notes:**

The number of samples has been decreased by the number of rejected samples. However, note that no positive results rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), excepts for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

## Surface Water

Twenty-one metals were detected in Wetland 15 surface water samples. Ten metals, including aluminum (213,000 ppb), arsenic (68.8 ppb), beryllium (3.2 ppb), chromium (327 ppb), copper (191 ppb), iron (715,000 ppb), lead (801 ppb), mercury (0.94 ppb), nickel (103 ppb), and zinc (1,010 ppb) exceeded saltwater surface water criteria at location 1501. Copper (4 ppb), iron (8,300 ppb), and lead (22.5 ppb) exceeded surface water criteria at location 1502. One pesticide, 4,4'-DDE, was detected in Wetland 15 surface water below its surface water criteria. No PCBs or SVOCs were detected in surface water at Wetland 15. No VOCs were detected in Wetland 15 surface water samples.

Table 10-10-2

## Wetland 15

## Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M150201</b>					
4,4'-DDD (UG/KG)		88 DJ	1.22	50.8%	b
4,4'-DDE (UG/KG)		110 DJ	2.07	53.14	b
4,4'-DDT (UG/KG)		4.3 J	1.18	3.61	b
alpha-Chlordane (UG/KG)		1.4 J	1.7	0.82	a
Atrichlor (MG/KG)		5 J	12	0.50	a
Aroclor-1260 (UG/KG)		24 J	21.6	1.11	b
Aroclor (MG/KG)		15.2	2.33	2.10	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)		450 J	182	2.69	b
Chromium (MG/KG)		35.7 J	52.3	0.67	a b
Copper (MG/KG)		20.8	19.7	1.08	a b
Endrin (UG/KG)		16 J	3.3	4.85	a
Fluoranthene (UG/KG)		240 J	113	2.12	b
Lead (MG/KG)		371	30.2	6.99	a b
Nickel (MG/KG)		12.4 J	15.9	0.78	a b
Pyrene (UG/KG)		210 J	153	1.37	b
Zinc (MG/KG)		59.9	121	0.48	a b
<b>041M150301</b>					
4,4'-DDD (UG/KG)		200 DJ	1.22	163.93	b
4,4'-DDE (UG/KG)		89 DJ	2.07	33.33	b
4,4'-DDT (UG/KG)		15 J	1.18	13.45	b
Aroclor-1260 (UG/KG)		32 J	21.6	1.48	b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 5) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb

Basewide level for 4,4'-DDD is 50 ppb

Basewide level for 4,4'-DDT is 20 ppb.

Table 10-10-2

## Wetland 15

## Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
Station 15-1	4,4'-DDT (UG/KG)	1.1	1.08	1.07	b
Station 15-2	4,4'-DDE (UG/KG)	10.1	2.07	4.83	b
Station 15-3	Arsenic (MG/KG)	2.5	7.24	0.35	a,b
Station 15-4	Benzo(a)pyrene (UG/KG)	59.1	68.8	0.65	b
Station 15-5	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	220.1	182	1.21	b
Station 15-6	Chromium (MG/KG)	20.8	52.3	0.40	a,b
Station 15-7	Copper (MG/KG)	5.5	18.7	0.28	a,b
Station 15-8	Endrin (UG/KG)	1.5	3.3	0.45	a
Station 15-9	Fluoranthene (UG/KG)	94.1	113	0.63	b
Station 15-10	Lead (MG/KG)	20.7	30.2	0.69	a,b
Station 15-11	Nickel (MG/KG)	5.6	15.9	0.35	a,b
Station 15-12	Pyrene (UG/KG)	120	153	0.78	b
Station 15-13	Zinc (MG/KG)	23.5	124	0.19	a,b

## 041M150401

4,4'-DDT (UG/KG)	1.1	1.08	1.07	b
4,4'-DDE (UG/KG)	10.1	2.07	4.83	b
Arsenic (MG/KG)	2.5	7.24	0.35	a,b
Benzo(a)pyrene (UG/KG)	59.1	68.8	0.65	b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	220.1	182	1.21	b
Chromium (MG/KG)	20.8	52.3	0.40	a,b
Copper (MG/KG)	5.5	18.7	0.28	a,b
Endrin (UG/KG)	1.5	3.3	0.45	a
Fluoranthene (UG/KG)	94.1	113	0.63	b
Lead (MG/KG)	20.7	30.2	0.69	a,b
Nickel (MG/KG)	5.6	15.9	0.35	a,b
Pyrene (UG/KG)	120	153	0.78	b
Zinc (MG/KG)	23.5	124	0.19	a,b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites:

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

Table 10-10-3 shows the Wetland 15 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-10-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only detected parameters with quality criteria are presented in Table 10-10-4. The HQs will be further discussed in the ecological risk section.

**Table 10-10-3**  
**Phase IIA Detected Concentrations in Wetland 15 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (µg/L)</b>			
Aluminum (Al)	2/2	934 - 213000	106967
Antimony (Sb)	½	32.4	32.4
Arsenic (As)	2/2	4.5 - 68.8	36.65
Barium (Ba)	2/2	34.7 - 642	338.35
Beryllium (Be)	½	3.2	3.2
Calcium (Ca)	2/2	87100 - 178000	132550
Chromium (Cr)	½	327	327
Cobalt (Co)	½	23.5	23.5
Copper (Cu)	2/2	4 - 191	97.5
Iron (Fe)	2/2	8300 - 715000	361650
Lead (Pb)	2/2	22.5 - 801	411.75
Magnesium (Mg)	2/2	34600 - 63700	49150
Manganese (Mn)	2/2	121 - 1640	880.5
Mercury (Hg)	½	0.94	0.94
Nickel (Ni)	½	103	103
Potassium (K)	2/2	11400 - 16000	13700
Selenium (Se)	½	16.3	16.3
Sodium (Na)	2/2	141000 - 174000	157500
Thallium (Tl)	½	3.2	3.2
Vanadium (V)	2/2	2 - 337	169.5
Zinc (Zn)	2/2	12.7 - 1010	511.35
<b>Pesticides and PCBs (µg/L)</b>			
4,4'-DDE	½	0.0630	0.0630

**Note:**

All results are in micrograms per liter (µg/L) or parts per billion (ppb).



Table 10-10-4 (1)

**Wetland 15****Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W150201	Saltwater					
	Aluminum	UG/L	884.0	1,500.0	0.62287	b
	Arsenic	UG/L	4.5	38.0	0.125	a
	Copper	UG/L	4.0	2.9	1.37931	a b
	Iron	UG/L	8,300.0	300.0	27.66667	b
	Lead	UG/L	22.5	5.6	4.01786	b
	Thallium	UG/L	3.2	6.3	0.50794	b
	Zinc	UG/L	12.7	98.0	0.14787	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### 10.10.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking, thus this evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-10-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented on Table 10-10-4.

#### Transport into the Wetland

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 15 through this pathway:

- Potential storm water runoff and sediment entrainment from Site 1, and the nearby area of the NAS golf course. During periods of high tide and storm surge, there is a direct surface water drainage through a tidal inlet that enters the wetland as well.

Table 10-10-5  
 Calculated Sediment Screening Values for Wetland 15

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Inorganics (ppb)	(ppb)		(ppm)	(ppm)	
Arsenic	36 <sup>a</sup>	2.9E+01	105	141	YES
Copper	2.9 <sup>a, b</sup>	4.3E+02	125	20.2	NO
Lead	5.6 <sup>b</sup>	9E+02	504	211	NO

Table 10-10-5  
 Calculated Sediment Screening Values for Wetland 15

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDE	0.14 <sup>a</sup>	8.68E+05	1.22E+07	340	NO
4,4 DDD	0.025 <sup>a</sup>	1.94E+05	4.85E+05	200	NO
4,4 DDT	0.001 <sup>a, b</sup>	5.1E+05	5.1E+04	16	NO
Endrin	0.0023 <sup>a, b</sup>	2.38E+03	547	16	NO
<b>Inorganics (ppb)</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Fluoranthene	1.6 <sup>a</sup>	2.08E+04	3.33E+06	240	NO
Pyrene	11,000 <sup>b</sup>	2.03E+04	2.23E+10	210	NO
Bis(2-ethylhexyl)phthalate	NA	2.93E+06	NA	490	NA

**Notes:**

Kd for organics calculated using foc of 0.194 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Criteria (1995a)

b = FDEP Class II Water Quality Criteria (1996)

The presence of sediment contaminants above benchmark levels (see Table 10-10-5) validates the sediment transport pathway and by inference the surface water pathway.

Additionally, there were ten inorganics present in surface water above water quality criteria, further validating the pathway.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential source that would directly contribute contamination to Wetland 15 through this pathway is Site 1, and potentially contaminated groundwater underlying the golf course. Groundwater at Site 1 has been shown to be contaminated, therefore the pathway is considered valid.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with land form analysis, indicates that the surface water and sediment transport will occur to the north through a small tidal inlet connecting the wetland with Bayou Grande. It is conceivable that during periods of very high tides or storm surges that some back flushing of surface water will occur within the wetland. Surface water and sediment can therefore be considered to be mobile, and the pathway valid for this wetland.

#### *Sediment Leaching to Surface Water Pathway*

Seven organics — four pesticides and three semivolatiles — and three inorganics, exceeded their sediment benchmark levels, but only one inorganic exceeded its calculated SSL (see Table 10-10-5). Notably, only inorganics were present in surface water above water quality criteria. The source of semivolatiles in sediment may have been airborne, given their typical low mobility and the lack of a direct source of semivolatiles near the wetland. Pesticide occurrence, given the proximity to the golf course and the historical application of pesticides, is not unexpected. Ten inorganics were present in surface water above water quality criteria, including the three that exceeded their benchmark levels and the one inorganic which exceeded its SSL. The source for most inorganics is likely related to the surface water and/or groundwater pathway, with the exception of arsenic, copper, and lead, which may be contributed from the sediment as well. Because one inorganic was detected in sediment above its SSL in conjunction with the three inorganic exceedances in surface water, the sediment leaching pathway is considered valid for this wetland.

## **Transport from the Wetland**

Transport of surface water and sediment from Wetland 15 can be expected to occur towards the north into the Bayou Grande system. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

### **10.10.4 Ecological Risk Assessment**

HQs for Wetland 15 sediment samples are presented in Table 10-10-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic (2.10 and 19.48 at locations 1502 and 1503), copper (1.08 and 1.01 at locations 1502 and 1503), and lead (1.31, 6.99, and 5.76 at locations 1501, 1502, and 1503). HQs also were greater than 1 for 4,4'-DDD/DDE at locations 1501 (68.97/164.25), 1502 (50.82/53.14), 1503 (163.93/33.33), and 1504 (1.07/4.83). The HQ for 4,4'-DDT was above 1 at locations 1501 (8.32), 1502 (3.61), and 1503 (13.45). The HQs for endrin at location 1502 (4.85) and endrin aldehyde at location 1501 (2.21) were also above 1. The PCB Aroclor-1260 also had an HQ above 1 at locations 1502 (1.11) and 1503 (1.48). HQs were also greater than 1 for the PAHs fluoranthene (1.77, 2.12, and 1.68 at locations 1501, 1502, and 1503) and pyrene (1.37 and 1.18 at locations 1502 and 1503); as well as the phthalate ester bis(2-ethylhexyl)phthalate (1.26, 2.69, and 1.21 at locations 1501, 1502, and 1504).

Phase IIA surface water results revealed HQs greater than 1 for aluminum (142.0), arsenic (1.91), beryllium (24.62), chromium (6.54), copper (65.86), iron (2,383.33), lead (143.04), mercury (37.6), nickel (12.41), and zinc (11.74) at location 1501. HQs were also above 1 for copper (1.38), iron (27.67), and lead (4.02) at location 1502. HQs greater than one indicate a potential for excess risk. High entained sediment of the sample likely contributed to the exceedances.

Wetland 15 was classified in Group C and was not sampled in Phase IIB based on Phase IIA data. Wetlands 18 and 16 were chosen to represent Group C because they had the highest levels of contamination in comparison to the other Group C Wetlands.

Risk in Wetland 16 was evaluated with respect to one assessment endpoint, survival, growth, and reproduction of macroinvertebrates associated with the benthic environment. Decision making triad results for Phase IIB/III Wetland 16 sediment analytical results (condition number 2) indicated that Wetland 16 sediment was acceptable and no further action was recommended for this medium.

Risk in Wetland 18 assessment endpoints were piscivorous bird health and reproduction; survival, growth, and reproduction of macroinvertebrates associated with the benthic environment; and protection of fish viability. Decision making triad results for Wetland 18 Phase IIB/III sediment and surface water analytical results (both condition number 3) indicated that Wetland 18 sediment and surface water were acceptable and no further action was recommended for either media at Wetland 18.

#### **10.10.5 Human Health Risk Assessment**

##### **10.10.5.1 Samples Included**

###### **Sediment**

041M15A101, 041M15A201, 041M15M301, 041M15M401

###### **Surface Water**

041W150101, 041W150201

##### **10.10.5.2 Current and Future Land Use**

This wetland is on the Navy golf course and could be an exposure point for golfers or trespassers looking for lost golf balls. The Navy enforces the no fishing/no swimming policy at this wetland. The adolescent trespasser and maintenance worker scenarios were considered conservatively representative of potential human receptors at this wetland.

#### **10.10.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.10.5.4 Sediment COPCs**

As shown in Table 10-10-6, the following sediment COPC was identified:

- Arsenic

#### **10.10.5.5 Surface Water COPCs**

As shown in Table 10-10-7, the following surface water COPCs were identified:

- Aluminum
- Arsenic
- Lead

#### **10.10.5.6 Risk Characterization**

##### ***Adolescent Trespasser***

Tables 10-10-8 through 10-10-11 detail cancer risk estimates and noncancer hazard estimates for this wetland under an adolescent trespasser scenario. As shown in Tables 10-10-8 and 10-10-9, arsenic is the only contributor to risk estimates for the sediment pathway under the adolescent trespasser scenario. Arsenic is the primary contributor to risk and hazard estimates for the surface water pathway as shown in Tables 10-10-10 and 10-10-11. Table 10-10-12 summarizes the risk and hazard estimates for Wetland 15. The cumulative risk estimated for this wetland is  $2.4E-5$  and the hazard index was estimated to be 0.5. Arsenic was identified as a COC for both sediment and surface water based on its contribution to the cumulative risk estimate for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below. Risk managers should also consider ecological endpoints.

TABLE 10-10-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Westport 15

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser Screening Toxicity Value	(5) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
108601	2,2'-oxybis(1-Chloropr	82.0000	J	82.0000	J	UG/KG	041M150401	1 / 4	2500.00 - 3000.00	82.00	82	N/A	N/A	N/A	N/A	NO	NTX
105679	2,4-Dimethylphenol	630.0000	J	630.0000	J	UG/KG	041M150101	1 / 4	1100.00 - 3000.00	630.00	630	N/A	6300000	9800000	N	N/A	BSL
78933	2-Butanone (MEK)	350.0000	J	350.0000	J	UG/KG	041M150101	1 / 4	43.00 - 77.00	350.00	350	N/A	190000000	290000000	N	N/A	BSL
95487	2-Methylphenol (o-Cres	330.0000	J	330.0000	J	UG/KG	041M150101	1 / 4	1100.00 - 3000.00	330.00	330	N/A	16000000	25000000	N	N/A	BSL
72548	4,4'-DDD	1.3000	J	200.00	DJ	UG/KG	041M150101	4 / 4	NAV	87.08	200	N/A	92000	57000	C	N/A	BSL
72559	4,4'-DDE	10.0000	J	340.00	DJ	UG/KG	041M150301	4 / 4	NAV	132.25	340	N/A	65000	40000	C	N/A	BSL
50293	4,4'-DDT	4.3000	J	16.0000	J	UG/KG	041M150101	3 / 4	0.59 - 0.59	10.07	16	N/A	65000	40000	C	N/A	BSL
106445	4-Methylphenol (p-Cres	4800.0000	J	4800.0000	J	UG/KG	041M150101	1 / 4	1100.00 - 3000.00	4800.00	4800	N/A	1600000	2500000	N	N/A	BSL
67641	Acetone	130.0000	J	1400.0000	J	UG/KG	041M150101	2 / 4	43.00 - 430.00	765.00	1400	N/A	32000000	49000000	N	N/A	BSL
5103719	alpha-Chlordane	1.4000	J	1.4000	J	UG/KG	041M150201	1 / 4	0.29 - 0.75	1.40	1.4	N/A	63000	39000	C	N/A	BSL
7429905	Aluminum (Al)	7810.0000	J	15800.00	J	MG/KG	041M150101	4 / 4	NAV	10235.00	15800	N/A	320000	490000	N	N/A	BSL
7440360	Antimony (Sb)	6.0000	J	6.0000	J	MG/KG	041M150401	1 / 4	0.72 - 2.00	6.00	6	N/A	130	200	N	N/A	BSL
11096825	Aroclor-1260	14.0000	J	32.0000	J	UG/KG	041M150201	3 / 4	5.90 - 5.90	23.33	32	N/A	11000	6900	C	N/A	BSL
7440382	Arsenic (As)	2.5000	J	141.00	J	MG/KG	041M150401	4 / 4	NAV	40.88	141	N/A	15	9.2	C	N/A	ASL
7440393	Barium (Ba)	6.2000	J	40.90	J	MG/KG	041M150201	4 / 4	NAV	25.90	40.9	N/A	22000	34000	N	N/A	BSL
50328	Benzo(a)pyrene	59.0000	J	59.0000	J	UG/KG	041M150401	1 / 4	250.00 - 300.00	59.00	59	N/A	3000	1900	C	N/A	BSL
205992	Benzo(b)fluoranthene	79.0000	J	250.0000	J	UG/KG	041M150401	3 / 4	300.00 - 300.00	176.33	250	N/A	30000	19000	C	N/A	BSL
7440417	Beryllium (Be)	0.3400	J	0.3400	J	MG/KG	041M150401	1 / 4	0.41 - 0.57	0.34	0.34	N/A	630	980	C	N/A	BSL
319857	beta-BHC	0.9400	J	1.4000	J	UG/KG	041M150201	2 / 4	0.29 - 0.63	1.17	1.4	N/A	12000	7600	C	N/A	BSL
117817	bis(2-Ethylhexyl)phthala	220.0000	J	490.0000	J	UG/KG	041M150401	3 / 4	2500.00 - 2500.00	313.33	490	N/A	1600000	980000	C	N/A	BSL
7440702	Calcium (Ca)	3010.0000	J	11300.00	J	MG/KG	041M150301	4 / 4	NAV	7205.00	11300	N/A	N/A	N/A	N/A	N/A	EN
7440473	Chromium (Cr)	14.3000	J	45.70	J	MG/KG	041M150201	4 / 4	NAV	29.63	45.7	N/A	1600	2500	N	N/A	BSL
7440484	Cobalt (Co)	1.5000	J	1.5000	J	MG/KG	041M150401	1 / 4	1.20 - 1.70	1.50	1.5	N/A	19000	29000	N	N/A	BSL
7440508	Copper (Cu)	5.5000	J	20.20	J	MG/KG	041M150101	4 / 4	NAV	13.28	20.2	N/A	13000	20000	N	N/A	BSL
319868	delta-BHC	5.5000	J	5.5000	J	UG/KG	041M150301	1 / 4	0.29 - 0.75	5.50	5.5	N/A	12000	7600	C	N/A	BSL
84742	Di-n-butylphthalate	130.0000	J	250.0000	J	UG/KG	041M150101	3 / 4	1100.00 - 1100.00	190.00	250	N/A	32000000	49000000	N	N/A	BSL
959988	Endosulfen I	1.7000	J	1.7000	J	UG/KG	041M150301	1 / 4	0.29 - 0.75	1.70	1.7	N/A	1900000	2900000	N	N/A	BSL
72208	Endrin	1.5000	J	16.0000	J	UG/KG	041M150101	3 / 4	1.30 - 1.30	6.67	16	N/A	95000	150000	N	N/A	BSL
7421934	Endrin aldehyde	1.3000	J	7.3000	J	UG/KG	041M150301	2 / 4	0.59 - 1.50	4.30	7.3	N/A	95000	150000	N	N/A	BSL
53494705	Endrin ketone	1.9000	J	1.9000	J	UG/KG	041M150101	1 / 4	0.59 - 1.50	1.90	1.9	N/A	95000	150000	N	N/A	BSL
206440	Fluoranthene	94.0000	J	240.0000	J	UG/KG	041M150301	4 / 4	NAV	87.08	240	N/A	13000000	20000000	C	N/A	BSL
76448	Heptachlor	1.1000	J	1.1000	J	UG/KG	041M150201	1 / 4	0.29 - 0.75	1.10	1.1	N/A	4900	3100	C	N/A	BSL
7439896	Iron (Fe)	11200.0000	J	223000.00	J	MG/KG	041M150201	4 / 4	NAV	70975.00	223000	N/A	N/A	N/A	N/A	N/A	EN
7439921	Lead (Pb)	20.7000	J	211.00	J	MG/KG	041M150401	4 / 4	NAV	111.35	211	N/A	400	400	N	OSWER	BSL
7439954	Magnesium (Mg)	912.0000	J	4980.00	J	MG/KG	041M150201	4 / 4	NAV	2575.50	4980	N/A	N/A	N/A	N	N/A	EN
7439965	Manganese (Mn)	47.7000	J	520.00	J	MG/KG	041M150101	4 / 4	NAV	204.65	520	N/A	15000	23000	N	N/A	BSL
75092	Methylene chloride	34.0000	J	34.0000	J	UG/KG	041M150101	1 / 4	43.00 - 110.00	34.00	34	N/A	1600	2500	C	N/A	BSL
7440020	Nickel (Ni)	5.6000	J	12.4000	J	MG/KG	041M150201	2 / 4	4.90 - 4.90	9.00	12.4	N/A	6300	9800	N	N/A	BSL
108952	Phenol	280.0000	J	280.0000	J	UG/KG	041M150101	1 / 4	1100.00 - 3000.00	280.00	280	N/A	190000000	290000000	N	N/A	BSL
7440097	Potassium (K)	310.0000	J	1460.00	J	MG/KG	041M150301	4 / 4	NAV	807.75	1460	N/A	N/A	N/A	N/A	N/A	EN
129000	Pyrene	120.0000	J	210.0000	J	UG/KG	041M150201	3 / 4	300.00 - 300.00	170.00	210	N/A	9500000	15000000	N	N/A	BSL
7782492	Selenium (Se)	0.9300	J	2.7000	J	MG/KG	041M150401	3 / 4	1.20 - 1.20	1.74	2.7	N/A	1600	2500	N	N/A	BSL
7440235	Sodium (Na)	206.0000	J	14200.00	J	MG/KG	041M150301	4 / 4	NAV	6526.50	14200	N/A	N/A	N/A	N/A	N/A	EN
7440622	Vanadium (V)	10.5000	J	36.00	J	MG/KG	041M150301	4 / 4	NAV	21.63	36	N/A	2200	3400	N	N/A	BSL
7440666	Zinc (Zn)	23.5000	J	83.60	J	MG/KG	041M150101	4 / 4	NAV	48.33	83.6	N/A	95000	150000	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Rationale Codes Selection Reason Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic



TABLE 10-10-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 15 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser Screening Toxicity Value	(4) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
72559	4,4'-DDE	0.063	J	0.0630	J	UG/L	041W150101	1 / 2	NAV	0.06	0.06	N/A	0.5	0.6	C	N/A	NO	BSL
7429905	Aluminum (Al)	934.000		213000.0000		UG/L	041W150101	2 / 2	NAV	106967.00	213000	N/A	120000	250000	N	N/A	YES	ASL
7440360	Antimony (Sb)	32.400	J	32.4000		UG/L	041W150101	1 / 2	NAV	32.40	32.4	N/A	48	100	N	N/A	NO	BSL
7440382	Arsenic (As)	4.500	J	68.8000		UG/L	041W150101	2 / 2	NAV	36.65	68.8	N/A	5.6	4.7	C	N/A	YES	ASL
7440393	Barium (Ba)	34.700	J	642.0000		UG/L	041W150101	2 / 2	NAV	338.35	642	N/A	8300	18000	N	N/A	NO	BSL
7440417	Beryllium (Be)	3.200	J	3.2000		UG/L	041W150101	1 / 2	NAV	3.20	3.2	N/A	240	500	C	N/A	NO	BSL
7440702	Calcium (Ca)	87100.000		178000.0000		UG/L	041W150101	2 / 2	NAV	132550.00	178000	N/A	N/A	N/A	N/A	NO	EN	
7440473	Chromium (Cr)	327.000		327.0000		UG/L	041W150101	1 / 2	NAV	327.00	327	N/A	360	760	N	N/A	NO	BSL
7440484	Cobalt (Co)	23.500	J	23.5000	J	UG/L	041W150101	1 / 2	NAV	23.50	23.5	N/A	7100	15000	N	N/A	NO	BSL
7440508	Copper (Cu)	4.000	J	151.0000		UG/L	041W150101	2 / 2	NAV	97.50	191	N/A	4800	10000	N	N/A	NO	BSL
7439896	Iron (Fe)	8300.000		715000.0000		UG/L	041W150101	2 / 2	NAV	361650.00	715000	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	22.500		801.0000		UG/L	041W150101	2 / 2	NAV	411.75	801	N/A	15	15	N	N/A	YES	ASL
7439954	Magnesium (Mg)	34600.000	0	63700.0000		UG/L	041W150101	2 / 2	NAV	49150.00	63700	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	121.000	J	1640.0000		UG/L	041W150101	2 / 2	NAV	880.50	1640	N/A	2400	5000	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.940	0	0.9400		UG/L	041W150101	1 / 2	NAV	0.94	0.94	N/A	N/A	N/A	N/A	NO	BSL	
7440020	Nickel (Ni)	103.000		103.0000		UG/L	041W150101	1 / 2	NAV	103.00	103	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	11400.000		16000.0000		UG/L	041W150101	2 / 2	NAV	13700.00	16000	N/A	N/A	N/A	N/A	NO	EN	
7782492	Selenium (Se)	16.300		16.3000		UG/L	041W150101	1 / 2	NAV	16.30	16.3	N/A	500	1300	N	N/A	NO	BSL
7440235	Sodium (Na)	141000.000		174000.0000		UG/L	041W150201	2 / 2	NAV	157500.00	174000	N/A	N/A	N/A	N/A	NO	EN	
7440280	Thallium (Tl)	3.200	J	3.2000		UG/L	041W150201	1 / 2	NAV	3.20	3.2	N/A	8.3	19	N	N/A	NO	BSL
7440622	Vanadium (V)	2.000	J	337.0000		UG/L	041W150101	2 / 2	NAV	189.50	337	N/A	830	1800	N	N/A	NO	BSL
7440686	Zinc (Zn)	12.700		1010.0000		UG/L	041W150101	2 / 2	NAV	511.35	1010	N/A	36000	76000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) RBCs for adolescent site trespasser scenario calculated using values presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(4) RBCs for commercial maintenance worker scenario calculated using values presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Detection Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-10-8  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 15  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	141	MG/KG	M	6.38E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	9.57E-06
Dermal	Arsenic	141	MG/KG	M	2.61E-07	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	1.96E-06
Total Risk All Exposure Routes/Pathways									1.15E-05

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-9  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 15  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	141	MG/KG	M	4.46E-05	mg/kg-day	3.00E-04	mg/kg-day	0.149
Dermal	Arsenic	141	MG/KG	M	1.83E-06	mg/kg-day	6.00E-05	mg/kg-day	0.031
Total Hazard Index Across All Exposure Routes/Pathways									0.179

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-10  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface water  
Exposure Medium: Surface water  
Exposure Point: Wetland 15  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.0688	MG/L	N/A	M	4.05E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	6.08E-06
Dermal	Arsenic	0.0688	MG/L	N/A	M	8.41E-07	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	6.31E-06
Total Risk										1.24E-05

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-11  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 15  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.0688	MG/L	N/A	M	2.83E-05	mg/kg-day	3.00E-04	mg/kg-day	0.094
	Aluminum	213	MG/L		M	8.80E-02	mg/kg-day	1.00E+00	mg/kg-day	0.088
Dermal	Arsenic	0.0688	MG/L		M	5.89E-06	mg/kg-day	6.00E-05	mg/kg-day	0.098
	Aluminum	213	MG/L		M	8.80E-03	mg/kg-day	2.00E-01	mg/kg-day	0.044
Total Hazard Index										0.32

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-12  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Site Trespasser  
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient				
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total	
Sediment	Sediment	Wetland 19	Arsenic	9.57E-06	1.96E-06	1.15E-05	Arsenic	skin	0.149	0.031	0.179	
			(Total)	9.57E-06	1.96E-06	1.15E-05	(Total)		0.149	0.031	0.179	
Surface Water	Surface Water	Wetland 19	Arsenic	6.08E-06	6.31E-06	1.24E-05	Arsenic	skin	0.094	0.098	0.19	
			(Total)	6.08E-06	6.31E-06	1.24E-05	Aluminum		gastrointestinal tract	0.088	0.044	0.13
							(Total)			0.182	0.142	0.32
Total Risk Across All Pathways						2.39E-05	Total Hazard Index Across All Pathways					0.50

### ***Maintenance Worker***

Tables 10-10-13 through 10-10-16 detail cancer and noncancer hazard estimates for this wetland under a maintenance worker scenario. As shown in Tables 10-10-13 and 10-10-15, arsenic is the only contributor to risk estimates for the sediment and surface water pathways under the maintenance worker scenario. Table 10-10-17 summarizes the risk and hazard estimates for Wetland 15 under a maintenance worker scenario. The cumulative risk estimated for this wetland is  $3.3\text{E-}5$  and the hazard index was estimated to be 0.28. Arsenic was identified as a COC for both sediment and surface water based on its contribution to the cumulative risk estimate for this wetland.

### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 15. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 15 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 15.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water per visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 15 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of  $68.8\text{ }\mu\text{g/L}$ , the annual alternate source exposure was estimated to be  $0.49\text{ }\mu\text{g lead/day}$ . Table 10-10-18 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

TABLE 10-10-13  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 15  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	141	MG/KG	N/A	M	1.02E-05	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	1.53E-05
Dermal	Arsenic	141	MG/KG	N/A	M	4.20E-07	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	3.15E-06
Total Risk All Exposure Routes/Pathways										1.85E-05

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



TABLE 10-10-14  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 15  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	141	MG/KG	N/A	M	2.70E-05	mg/kg-day	3.00E-04	mg/kg-day	0.090
Dermal	Arsenic	141	MG/KG	N/A	M	1.18E-06	mg/kg-day	6.00E-05	mg/kg-day	0.020
Total Hazard Index Across All Exposure Routes/Pathways										0.11

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-15  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface water  
Exposure Medium: Surface water  
Exposure Point: Wetland 15  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.0688	MG/L	N/A	M	6.50E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	9.75E-06
Dermal	Arsenic	0.0688	MG/L	N/A	M	6.50E-07	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	4.88E-06
Total Risk										1.46E-05

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-16  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 15  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.0688	MG/L	N/A	M	1.82E-05	mg/kg-day	3.00E-04	mg/kg-day	0.061
	Aluminum	213	MG/L		M	5.60E-02	mg/kg-day	1.00E+00	mg/kg-day	0.056
Dermal	Arsenic	0.0688	MG/L		M	1.82E-06	mg/kg-day	6.00E-05	mg/kg-day	0.030
	Aluminum	213	MG/L		M	5.60E-03	mg/kg-day	2.00E-01	mg/kg-day	0.028
Total Hazard Index										0.18

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-10-17  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total
Sediment	Sediment	Wetland 19	Arsenic	1.53E-05	3.15E-06	1.85E-05	Arsenic	skin	0.090	0.020	0.11
			(Total)	1.53E-05	3.15E-06	1.85E-05	(Total)		0.090	0.020	0.11
Surface Water	Surface Water	Wetland 19	Arsenic	9.75E-06	4.88E-06	1.46E-05	Arsenic	skin	0.061	0.030	0.091
			(Total)	9.75E-06	4.88E-06	1.46E-05	(Total)		0.056	0.028	0.084
								gastrointestinal tract	0.117	0.058	0.175
Total Risk Across All Wetlands						3.31E-05	Total Hazard Index Across All Wetlands				0.28

Figure 10-10-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 2.7  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.28%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, surface water lead concentrations at Wetland 15 would not require specific action under the hypothetical exposure scenario.

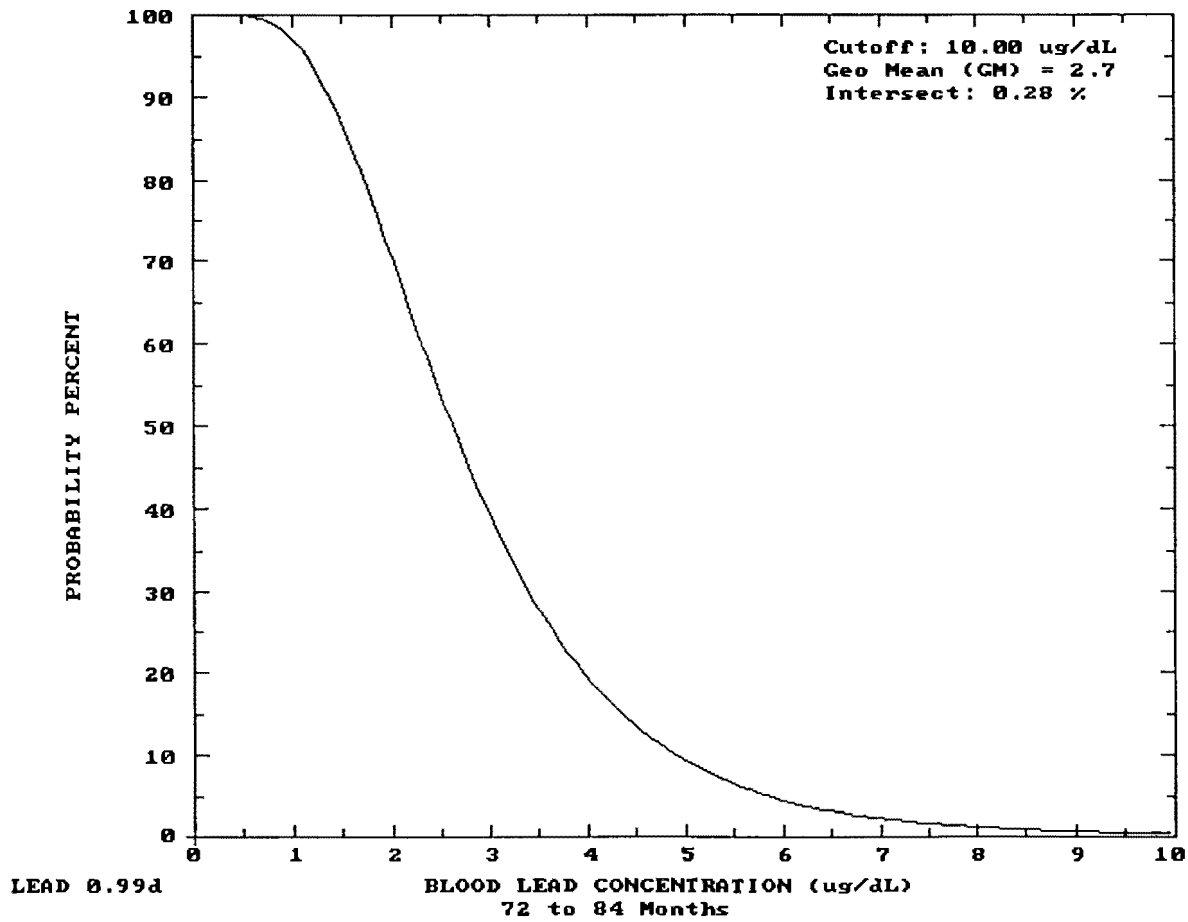
#### 10.10.5.7 Remedial Goal Options

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was identified as a COC for both sediment and surface water for Wetland 15. Because arsenic was identified as a COC for both media based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed.

#### *Adolescent Trespasser*

As shown in Table 10-10-8, the maximum sediment concentration of 141 mg/kg-day, used as an exposure point concentration, resulted in a risk estimate of 1.15E-5 for arsenic. Using a linear ratio, a target risk of 1E-6 would result from 12.24 mg/kg. Therefore, 122.4 mg/kg and 1224 mg/kg represent target risks of 1E-5 and 1E-4, respectively. An exposure point concentration of 0.0688 mg/L for arsenic in surface water resulted in a risk estimate of 1.24E-5, as shown in Table 10-10-10. Using a linear ratio, 0.0056 mg/L would correspond with a target risk of 1E-6. Therefore, 0.056 mg/L and 0.56 mg/L represent target risks of 1E-5 and 1E-4, respectively.

Figure 10-10-2 Probability Percentage of Blood Lead Levels



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Table 10-10-18  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 15  
 Pensacola, Florida

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 15 surface water

6-7: 0.49  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil+Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	2.7	9.70	4.89	3.35	1.13	0.23	0.09



### ***Maintenance Worker***

As shown in Table 10-10-13, the sediment exposure point concentration of 141 mg/kg-day resulted in a risk estimate of  $1.85\text{E-}5$  for arsenic. Using a linear ratio, a target risk of  $1\text{E-}6$  would result from 7.48 mg/kg. Therefore, 74.8 mg/kg and 748 mg/kg represent target risks of  $1\text{E-}5$  and  $1\text{E-}4$ , respectively. A surface water exposure point concentration of 0.0688 mg/L resulted in a risk estimate of  $1.46\text{E-}5$ , as shown in Table 10-10-15. Using a linear ratio, 0.0047 mg/L would correspond with a target risk of  $1\text{E-}6$ . Therefore, 0.047 mg/L and 0.47 mg/L represent target risks of  $1\text{E-}5$  and  $1\text{E-}4$ , respectively.

### **10.10.6 Conclusions and Recommendations**

Wetlands 16 and 18 were sampled to represent the Group C wetlands in Phase IIB/III. Wetland 15 has similar contaminants (metals and pesticides/PCBs) as Wetlands 16 and 18, and is also tidally influenced by Bayou Grande. Comparison of Wetland 15 to the Group C representative wetlands (Wetlands 16 and 18) indicate no excess risk for sediment and surface water at Wetland 15.

The HHRA identified arsenic as a sediment COPC, and aluminum, arsenic, and lead as surface water COPCs at Wetland 15. However, since the wetland has no recreational value for swimming or fishing and is not routinely entered by maintenance workers (due to the thick vegetation and the potential for encountering poisonous snakes, such as the cottonmouth), the potential for incidental ingestion of sediment or surface water is considered low.

Because of the limited overall ecological risk at Wetland 15, and the limited potential for sediment or surface water ingestion by adolescent trespassers or maintenance workers, no further action is recommended for Wetland 15.

## 10.11 WETLAND 6

### 10.11.1 Site Description

Wetland 6 is a tile lined drainage ditch that originates at the parade grounds north of the NAS Pensacola Chapel and drains to the north into the Yacht Basin. Parsons and Pruitt described this area as a riverine wetland with open water (USEPA, 1991). Wetland 6 is roughly eight feet wide and three feet deep, with water depth averaging one to two feet. Portions of Wetland 6 are tidally influenced. It receives surface water and storm water runoff from various places along the eastern portion of the base including:

- The area near the NAS Pensacola Chapel and surrounding parade grounds.
- The western portion of NATTC at the former Chevalier Field.
- The area behind Buildings 3220 and 3440 (to the west of the former Chevalier Field).
- Wetland 5B, which receives surface water from Wetland 5A and the surrounding area.
- The storage yard used by the Defense Reutilization and Marketing Office (DRMO) at the Naval Supply Center.

Wetland 6 flows north, past NATTC, discharging into the southernmost portion of the Yacht Basin (Wetland 64). Wetland 6 is surrounded by either landscape areas, buildings and/or development, or isolated areas of highly disturbed vegetation. Vegetation growing in Wetland 6 includes duck potato (*Sagittaria sp.*). Small fish and crayfish have also been seen in Wetland 6. Since this wetland is a drainage ditch, it is periodically cleared of vegetation by base landscaping contractors. Sediment in Wetland 6 is very sandy, with a maximum TOC content of 4% detected.

IR sites potentially affecting Wetland 5 include Sites 9, 10, 12, 25, 26, 27, 29, and 34, which are all adjacent to or near this wetland. Site 9 was used as the station disposal site for the old Navy yard. Site 10 (Commodore's Pond) was used in the mid-nineteenth century for underwater storage of wooden timbers for shipbuilding. Site 12 (Scrap Bins) was the location

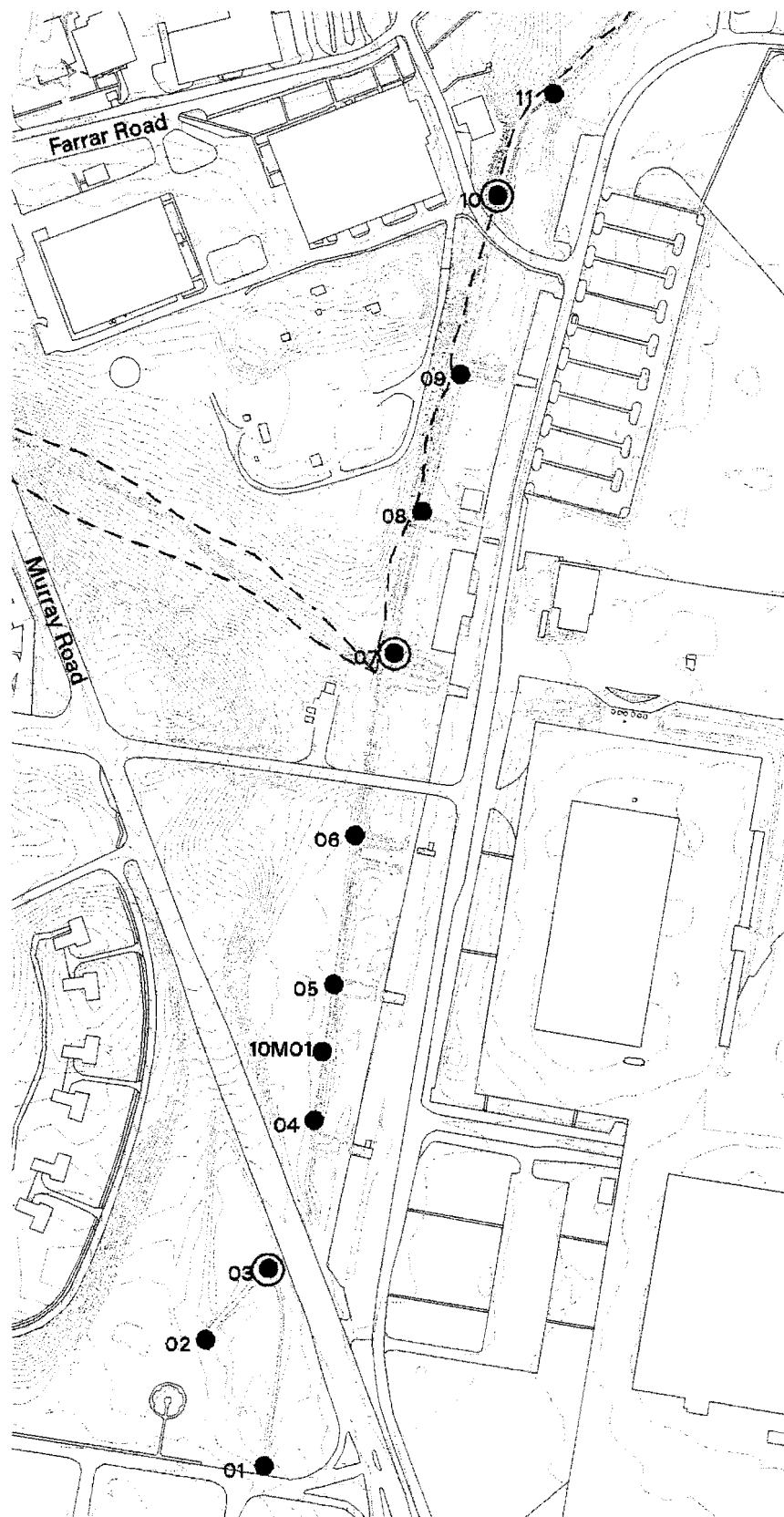
where wet garbage was deposited in receptacles from the early thirties through the forties, and is currently used as a storage yard by the DRMO. Site 25 (Radium Spill Site) was the location of a radium spill which occurred in 1978. Site 26 (Supply Department Outside Storage) was the industrial chemical storage location from 1956 through 1964, and is still used to store various chemicals. Site 27 (Radium Dial Shop Sanitary Sewer) was associated with the Radium Dial Shop in Building 709 from 1940 to 1976. Site 29 (Soil South of Building 3460) is where several workers conducting an excavation received minor skin burns from contact with a black, oily liquid found in the soil in 1981. Site 34 (Solvent north of Building 3557) is the location of a 1984 solvent spill which occurred at a tank farm to the north of Building 3557.

#### **10.11.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-11-1 denotes Phase IIA Wetland 6 sampling locations.

#### **Sediment**

Twenty-three metals were detected in Wetland 6 sediment samples. Six metals, including cadmium (four locations), chromium (one location), copper (three locations), lead (five locations), silver (one location), and zinc (one location), exceeded sediment benchmark levels. Twelve pesticides were detected in Wetland 6 sediment samples, including 4,4' DDT and its metabolites, aldrin, alpha/beta-BHC, dieldrin, endrin, endrin aldehyde, heptachlor, and alpha/gamma-chlordane. DDT and/or its metabolites exceeded benchmark levels at 10M01, 0601, 0602, 0603, 0604, 0605, 0606, 0607, and 0608. However, basewide levels were only exceeded for 4,4'-DDE (110 ppb at location 0601) and 4,4'-DDT (260 ppb/52 ppb at locations 0601 and 0603). Basewide levels are presented in Section 6. Dieldrin also exceeded its benchmark sediment level at five locations. Endrin exceeded its benchmark level (3.3 ppb) at 0607 (3.6 ppb). The PCBs Aroclor-1254/1260 were also detected; however, no PCB concentration exceeded sediment screening levels. Fifteen SVOCs were detected in Wetland 6 sediment samples, including 11 high and low molecular weight PAHs, and four phthalate esters. Three PAHs exceeded sediment benchmark levels, including acenaphthene (34 ppb at location 0604), chrysene



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

FIGURE 10-11-1  
PHASE IIA WETLAND 6  
SAMPLING LOCATIONS

(300 ppb at location 0607), and fluoranthene (120 ppb at location 0602). Eight VOCs, including 1,1,1-trichloroethane, 1,1-dichloroethene, acetone (a common laboratory contaminant), chlorobenzene, chloroethane, tetrachloroethane, toluene, and trichloroethene were detected.

Table 10-11-1 shows the Wetland 6 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-11-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only detected parameters with benchmark levels are presented in Table 10-11-2. The HQs will be further discussed in the ecological risk section (Section 10.11.4).

### **Surface Water**

Thirteen metals were detected in Wetland 6 surface water samples. Aluminum (287 ppb), cyanide (5.6 ppb), mercury (0.88 ppb), and lead (3.1 ppb) exceeded surface water criteria at sample location 0610. Aluminum also exceeded surface water criteria at sample location 0607 (406 ppb). No pesticides or PCBs were detected in Wetland 6 surface water. Bis(2-ethylhexyl)phthalate was the only SVOC detection in Wetland 6 surface water samples, exceeding its surface water quality criteria (0.3 ppb) at sample location 0610 (3 ppb). Six VOCs were detected in Wetland 6 surface water samples, including 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, methylene chloride (a common laboratory contaminant), and trichloroethene. 1,1-dichloroethene (8 ppb) exceeded its surface water quality criteria (3.2 ppb) at sample location 0610.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-11-1  
 Phase IIA Detected Concentrations in Wetland 6 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	12/12	313 - 5980	1561
Antimony (Sb)	2/12	0.16 - 0.32	0.24
Arsenic (As)	9/12	0.14 - 2.1	0.70
Barium (Ba)	11/12	1 - 37	9.54
Beryllium (Be)	3/12	0.1 - 0.14	0.12
Cadmium (Cd)	9/12	0.19 - 5.4	1.00
Calcium (Ca)	12/12	62.5 - 8370	2147.13
Chromium (Cr)	11/12	0.56 - 73.5	15.59
Cobalt (Co)	7/12	0.18 - 20.7	3.53
Copper (Cu)	11/12	0.97 - 48.2	13.04
Iron (Fe)	12/12	328 - 4320	1336.33
Lead (Pb)	12/12	6 - 147	31.5
Magnesium (Mg)	11/12	27.3 - 1180	386.25
Manganese (Mn)	11/12	1.2 - 35.2	13.39
Mercury (Hg)	1/12	0.11	0.11
Nickel (Ni)	7/12	0.84 - 4.3	2.06
Potassium (K)	11/12	9.6 - 161	55.09
Selenium (Se)	1/12	0.85	0.85
Silver (Ag)	1/12	0.89	0.89
Sodium (Na)	9/12	4.9 - 105	33.93
Thallium (Tl)	2/12	0.67 - 0.68	0.68
Vanadium (V)	12/12	0.6 - 11.3	2.83
Zinc (Zn)	11/12	9.7 - 207	54.67
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	12/12	0.21 - 40	12.08
4,4'-DDE	11/12	0.23 - 110	21.17
4,4'-DDT	11/12	0.22 - 260	31.71
Aldrin	5/12	0.23 - 1.1	0.59
Aroclor-1254	1/12	9.5	9.5
Aroclor-1260	3/12	0.82 - 4.1	2.91
Dieldrin	8/12	0.24 - 10	3.44
Endrin	4/12	1.8 - 3.6	2.5
Endrin aldehyde	1/12	0.48	0.48
Heptachlor	1/12	0.16	0.16
alpha-BHC	2/12	0.48 - 0.6	0.54
alpha-Chlordane	6/12	0.15 - 1.7	0.84
beta-BHC	3/12	0.16 - 2.8	1.49
gamma-Chlordane	6/12	0.19 - 1.2	0.52

Table 10-11-1  
 Phase IIA Detected Concentrations in Wetland 6 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Acenaphthene	1/11	34	34
Benzo(a)anthracene	3/11	34 - 43	39
Benzo(a)pyrene	4/11	23 - 42	32.5
Benzo(b)fluoranthene	5/11	27 - 340	107.8
Benzo(g,h,i)perylene	2/11	29 - 32	30.5
Benzo(k)fluoranthene	2/11	21 - 24	22.5
Butylbenzylphthalate	6/11	22 - 30	25.17
Chrysene	4/11	21 - 300	105.25
Di-n-butylphthalate	4/11	29 - 99	57.25
Di-n-octyl phthalate	1/11	84	84
Diethylphthalate	1/11	23	23
Fluoranthene	4/11	42 - 120	79.25
Indeno(1,2,3-cd)pyrene	2/11	27 - 28	27.5
Phenanthrene	2/11	37 - 51	44
Pyrene	4/11	52 - 100	73.5
<b>VOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
1,1,1-Trichloroethane	1/12	4	4
1,1-Dichloroethene	1/12	8	8
Acetone	7/11	13 - 4000	743.86
Chlorobenzene	1/12	2	2
Chloroethane	1/12	2	2
Tetrachloroethene	2/12	2 - 4	3
Toluene	3/12	4 - 14	8
Trichloroethene	3/12	2 - 5	3.33

**Notes:**

All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

The total number of samples, has been reduced by the number of rejected samples. However, note that no positive results rejected.

**Table 10-11-2**  
**Wetland 6**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>010M000101</b>					
	4,4'-DDD (UG/KG)	37 J	122	30.33	b
	4,4'-DDE (UG/KG)	29 J	2.07	14.01	b
	4,4'-DDT (UG/KG)	11 J	1.19	9.24	b
	Copper (MG/KG)	14.2 J	18.7	0.76	a b
	Lead (MG/KG)	31.4	30.2	1.04	a b
	Nickel (MG/KG)	4.3	15.9	0.27	a b
	Zinc (MG/KG)	59.6 J	124	0.48	a b
<b>041M060201</b>					
	4,4'-DDD (UG/KG)	3.1 J	122	2.54	b
	4,4'-DDE (UG/KG)	2.6 J	2.07	1.36	b
	4,4'-DDT (UG/KG)	0.35 J	1.19	0.29	b
	alpha-Chlordane (UG/KG)	0.23 J	1.7	0.14	a
	Aroclor-1254 (UG/KG)	9.5 J	21.6	0.44	b
	Arsenic (MG/KG)	0.28 J	7.24	0.04	a b
	Benzo(a)anthracene (UG/KG)	43	74.8	0.57	b
	Benzo(a)pyrene (UG/KG)	42	88.8	0.47	b
	Cadmium (MG/KG)	0.33	0.68	0.49	b

**Notes**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 8) for DDT and its metabolites.  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.



Table 10-11-2  
Wetland 5  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	Chromium (MG/KG)	2	52.3	0.04	a b
	Chrysene (UG/KG)	45	108	0.42	b
	Copper (MG/KG)	8.3 J	18.7	0.44	a b
	Fluoranthene (UG/KG)	120	113	1.08	b
	gamma-Chloridane (UG/KG)	0.2 J	1.7	0.12	a
	Lead (MG/KG)	10.9 J	30.2	0.36	a b
	Nickel (MG/KG)	0.84 J	15.8	0.05	a b
	Phenanthrene (UG/KG)	37 J	86.7	0.43	b
	Pyrene (UG/KG)	100	153	0.65	b
	Zinc (MG/KG)	29.5 J	124	0.24	a b

[illegible]

## 041M060401

4,4'-DDD (UG/KG)	2.3 J	1.22	1.89	b
4,4'-DDE (UG/KG)	4.3	2.07	2.08	b
4,4'-DDT (UG/KG)	2 J	1.19	1.68	b
Acenaphthene (UG/KG)	34	6.71	5.07	b
Chromium (MG/KG)	0.85	52.3	0.02	a b
Chrysene (UG/KG)	21 J	108	0.19	b
Copper (MG/KG)	13.6 J	18.7	0.73	a a
Fluoranthene (UG/KG)	42	113	0.37	b
Lead (MG/KG)	16.2 J	30.2	0.54	a b
Pyrene (UG/KG)	52	153	0.34	b

### Notes

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.  
Basewide level for 4,4'-DDE is 20 ppb.

**Table 10-11-2**  
**Wetland 6**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	Zinc (MG/KG)	28.1 J	124	0.23	a b
<b>Summary</b>					
	4,4'-DDD (UG/KG)	8.3 D	1.22	6.80	b
	4,4'-DDE (UG/KG)	8 D	2.07	3.86	b
	4,4'-DDT (UG/KG)	4.8 J	1.19	4.03	b
	alpha-Chlordane (UG/KG)	0.25 J	1.7	0.15	a
	Antimony (MG/KG)	0.32 J	12	0.03	a
	Aroclor-1260 (UG/KG)	4.1 J	21.6	0.19	b
	Arsenic (MG/KG)	1.4	7.24	0.19	a b
	Benzo(a)anthracene (UG/KG)	40 J	74.8	0.53	b
	Benzo(a)pyrene (UG/KG)	32 J	88.8	0.36	b
	Cadmium (MG/KG)	0.76	0.68	1.12	b
	Chromium (MG/KG)	7.6	52.3	0.14	a b
	Copper (MG/KG)	19	18.7	1.02	a b
	Dieldrin (UG/KG)	4.7	0.72	6.53	b
	Fluoranthene (UG/KG)	87	113	0.59	b
	gamma-Chlordane (UG/KG)	0.15 J	1.7	0.11	a
	Lead (MG/KG)	49.1	30.2	1.63	a b
	Nickel (MG/KG)	1.3 J	15.9	0.08	a b
	Pyrene (UG/KG)	69	153	0.45	b
	Zinc (MG/KG)	75.7	124	0.61	a b
<b>Summary</b>					
	4,4'-DDD (UG/KG)	8.3 D	1.22	6.80	b
	4,4'-DDE (UG/KG)	8 D	2.07	3.86	b
	4,4'-DDT (UG/KG)	4.8 J	1.19	4.03	b
	alpha-Chlordane (UG/KG)	0.25 J	1.7	0.15	a
	Antimony (MG/KG)	0.32 J	12	0.03	a
	Aroclor-1260 (UG/KG)	4.1 J	21.6	0.19	b
	Arsenic (MG/KG)	1.4	7.24	0.19	a b
	Benzo(a)anthracene (UG/KG)	40 J	74.8	0.53	b
	Benzo(a)pyrene (UG/KG)	32 J	88.8	0.36	b
	Cadmium (MG/KG)	0.76	0.68	1.12	b
	Chromium (MG/KG)	7.6	52.3	0.14	a b
	Copper (MG/KG)	19	18.7	1.02	a b
	Dieldrin (UG/KG)	4.7	0.72	6.53	b
	Fluoranthene (UG/KG)	87	113	0.59	b
	gamma-Chlordane (UG/KG)	0.15 J	1.7	0.11	a
	Lead (MG/KG)	49.1	30.2	1.63	a b
	Nickel (MG/KG)	1.3 J	15.9	0.08	a b
	Pyrene (UG/KG)	69	153	0.45	b
	Zinc (MG/KG)	75.7	124	0.61	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 60 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-11-2  
Wetland 6  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
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041M060801

4,4'-DDD (UG/KG)	5.4 D	1.22	3.25	b
4,4'-DDE (UG/KG)	8.4 D	2.07	4.06	b
4,4'-DDT (UG/KG)	4.5 J	1.19	3.73	b
alpha-Chlordane (UG/KG)	1.2	1.7	0.71	a
Arsenic (MG/KG)	0.14 J	7.24	0.02	a b
Cadmium (MG/KG)	0.19 J	0.68	0.20	b
Chromium (MG/KG)	19.8	52.3	0.37	a b
Copper (MG/KG)	0.97 J	19.7	0.05	a b
Dieldrin (UG/KG)	5.6	0.72	7.79	b
Endrin (UG/KG)	1.8 J	3.3	0.55	a
Endrin aldehyde (UG/KG)	0.48 J	3.3	0.15	a
gamma-Chlordane (UG/KG)	0.44 J	1.7	0.26	a
Lead (MG/KG)	6.8	30.2	0.22	a b

041M060802

4,4'-DDD (UG/KG)	1.4 J	1.22	3.25	b
4,4'-DDE (UG/KG)	2.1 J	2.07	4.06	b
4,4'-DDT (UG/KG)	1.5 J	1.19	3.73	b
alpha-Chlordane (UG/KG)	1.0 J	1.7	0.71	a
Arsenic (MG/KG)	0.18 J	7.24	0.02	a b
Cadmium (MG/KG)	0.18 J	0.68	0.20	b
Chromium (MG/KG)	1.0 J	52.3	0.37	a b
Copper (MG/KG)	0.1 J	19.7	0.05	a b
Dieldrin (UG/KG)	1.0 J	0.72	7.79	b
Endrin (UG/KG)	0.1 J	3.3	0.55	a
Endrin aldehyde (UG/KG)	0.1 J	3.3	0.15	a
gamma-Chlordane (UG/KG)	0.1 J	1.7	0.26	a
Lead (MG/KG)	0.1 J	30.2	0.22	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 5) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-11-2  
Wetland 6  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M061101</b>					
1.0 m	4,4'-DDD (UG/KG)	0.21 J	1.22	0.17	b
1.0 m	4,4'-DDE (UG/KG)	0.28	2.07	0.14	b
1.0 m	Aroclor-1260 (UG/KG)	3.8 J	21.6	0.18	b
1.0 m	Arsenic (MG/KG)	0.3 J	7.24	0.04	a b
1.0 m	Benzo(a)pyrene (UG/KG)	23 J	88.8	0.26	b
1.0 m	Cadmium (MG/KG)	0.72	0.69	1.06	b
1.0 m	Chromium (MG/KG)	22.4	52.3	0.43	a b
1.0 m	Copper (MG/KG)	4	18.7	0.21	a b
1.0 m	Dieldrin (UG/KG)	0.3 J	0.72	0.42	b
1.0 m	Lead (MG/KG)	6	30.2	0.20	a b
1.0 m	Nickel (MG/KG)	0.96 J	15.9	0.06	a b
1.0 m	Zinc (MG/KG)	19.3	124	0.15	a b

Notes

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-11-3 shows the Wetland 6 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-11-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-11-4. The HQs will be further discussed in the ecological risk section (Section 10.11.4).

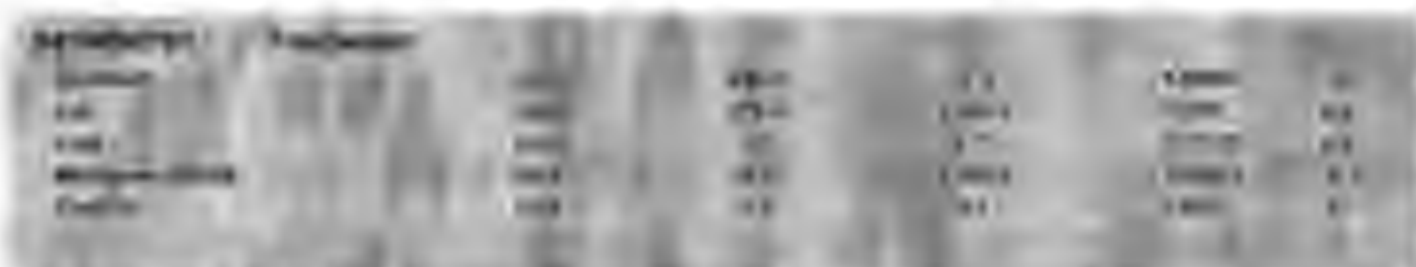
**Table 10-11-3**  
**Phase IIA Detected Concentrations in Wetland 6 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/3	287 - 406	346.5
Barium (Ba)	2/3	15.9 - 30.5	23.2
Calcium (Ca)	3/3	18300 - 24700	20700
Cyanide (CN)	1/3	5.6	5.6
Iron (Fe)	3/3	334 - 870	526.67
Lead (Pb)	2/3	1.2 - 3.1	2.15
Magnesium (Mg)	3/3	1910 - 3480	2610
Manganese (Mn)	3/3	19.5 - 55.7	36.2
Mercury (Hg)	1/3	0.88	0.88
Potassium (K)	3/3	1520 - 3050	2163
Sodium (Na)	3/3	10300 - 13800	11966.67
Thallium (Tl)	1/3	3.3	3.3
Vanadium (V)	2/3	2.1 - 2.3	2.2
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
bis(2-Ethylhexyl)phthalate (BEHP)	1/3	3	3
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
1,1-Dichloroethane	1/3	5	5
1,1-Dichloroethene	1/3	8	8
1,1,1-Trichloroethane	1/3	5	5
cis-1,2-Dichloroethene	1/3	2	2
Methylene chloride	1/3	13	13
Trichloroethene	1/3	1	1

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

**Table 10-11-4 (1)**  
**Wetland 6**  
**Phase IIa Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UQM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W060301</b>	<b>Freshwater</b>					
Iron		UG/L	334.0	1,000.0	0.334	a b
						
<b>041W061001</b>	<b>Freshwater</b>					
1,1,1-Trichloroethane		UG/L	5.0	528.0	0.00947	a
1,1-Dichloroethene		UG/L	8.0	3.2	2.5	b
Aluminum		UG/L	287.0	87.0	3.29665	a
bis(2-Ethylhexyl)phthalate (BEHP)		UG/L	3.0	0.3	10.0	a
Cyanide (CN)		UG/L	5.6	6.2	1.07692	a b
Iron		UG/L	870.0	1,000.0	0.87	a b
Lead		UG/L	3.1	1.71	1.81287	a b
Mercury		UG/L	0.85	0.012	73.33333	a b
Trichloroethane		UG/L	1.0	80.7	0.01239	b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### **10.11.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-11-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria were presented on Table 10-11-4.

#### **Transport Into the Wetland**

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analyses, the following sources can contribute contamination to Wetland 6 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 9, 29, 34, 10, 12, and 26; numerous stormwater scuppers along the NATTC complex and drainage from Murray Road; direct surface water drainage from Wetland 5, which receives runoff from Sites 30, 25, and 27.

The presence of sediment contaminants above benchmark levels (see Table 10-11-5) validates the sediment transport pathway and by inference the surface water pathway. Additionally, there were four inorganics and two organics present in surface water above water quality criteria, further validating the pathway.

Table 10-11-5  
 Calculated Sediment Screening Values for Wetland 6

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppb)		(ppm)	(ppm)	
Cadmium	0.774 <sup>a, b</sup>	7.5E+01	5.82	5.4	NO
Chromium	11 <sup>a, b</sup>	1.9E+01	21.04	73.5	YES
Copper	7.8 <sup>a, b</sup>	4.3E+02	335.5	48.2	NO
Lead	1.71 <sup>a, b</sup>	9E+02	153.9	147	NO
Silver	0.07 <sup>b</sup>	8.3	59	0.89	NO
Zinc	70.2 <sup>a, b</sup>	6.2E+01	436.2	207	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4 DDE	10.5 <sup>a</sup>	3.33E+04	3.50E+07	110	NO
4,4 DDD	0.0064 <sup>a</sup>	7.45E+03	4.77E+03	40	NO
4,4 DDT	0.001 <sup>a, b</sup>	1.96E+04	1.96E+03	260	NO
Alpha Chlordane	0.004 <sup>a, b</sup>	9.00E+02	3.6E+02	0.70	NO
Dieldrin	0.0019 <sup>a, b</sup>	1.6E+02	3.04E+01	10	NO
Endrin	0.0023 <sup>a, b</sup>	9.22E+01	2.12E+01	3.60	NO
Acenaphthene	17 <sup>a</sup>	58.17	9.91E+04	34	NO
Chrysene	0.031 <sup>b</sup>	2.96E+03	9.19E+03	300	NO
Fluoranthene	39.8 <sup>a</sup>	7.98E+02	3.18E+06	120	NO

**Notes:**

Kd for organics calculated using foc of 0.0075 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the primary potential source that would directly contribute contamination to Wetland 6 through this pathway are Sites 9, 10, 12, 26 and 29; indirect sources include Sites 30, 25, and 27. Groundwater at Sites 9, 10, 12, 26 and 29 is not contaminated, but at Sites 30, 25, and 27 groundwater is contaminated; therefore the pathway is considered valid.



## **Transport within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of Wetland 6, along with landform analysis, indicates that the surface water and sediment transport will occur to the north, towards Wetland 64, and eventually Bayou Grande. It is conceivable that during periods of very high tides or storm surges that some back flushing of surface water will occur, particularly within the northern portion of Wetland 6. Surface water and sediment can therefore be considered to be mobile, and the pathway valid.

### *Sediment Leaching to Surface Water Pathway*

Nine organics — six pesticides and three semivolatiles — and six inorganics, exceeded their benchmark levels, but only one inorganic exceeded its calculated SSL. The source for inorganics and semivolatiles in sediment is likely associated with storm water drainage from the former Chevalier Field, and surface water drainage from Wetland 5, while pesticides are the likely representative of residual from surface application near the wetland. There were four inorganics and two organics present in surface water above water quality criteria, but only lead exceeded its benchmark level in sediment. Except for chromium, the sources for these parameters in surface water may be attributed to the surface water and groundwater discharge pathways, while sediment leaching may be contributing to the chromium concentration. Given that chromium did exceed its SSL but is below its surface water criteria, the sediment leaching pathway is considered valid.

## **Transport from the Wetland**

Transport of surface water and sediment from Wetland 6 can be expected to occur towards the north into Wetland 64, and eventually into the Bayou Grande system. Therefore sediment and surface water contamination can be expected to be mobile and not remain within the wetland.

#### **10.11.4 Ecological Risk Assessment**

HQs for Wetland 6 sediment samples are presented in Table 10-11-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for cadmium (four locations), chromium (one location), copper (three locations), lead (five locations), silver (one location), and zinc (one location). HQs were greater than 1 for 4,4'-DDT and/or its metabolites at 10M01, 0601, 0602, 0603, 0604, 0605, 0606, 0607, and 0608. Dieldrin had a HQ above 1 at five locations, and endrin at one location. Three PAHs had HQs greater than 1, including acenaphthene (5.07 at location 0604), chrysene (2.78 at location 0607), and fluoranthene (1.06 at location 0602). Phase IIA surface water results revealed HQs greater than 1 for aluminum at sample locations 0607 (4.67) and 0610 (3.29); as well as cyanide (1.08), mercury (76.33), and lead (1.81) at sample location 0610. Bis(2-ethylhexyl)phthalate had a HQ of 10 at location 0610. The VOC 1,1-dichloroethene also had an HQ above 1 at sample location 0610 (2.5). HQs greater than one indicate a potential for excess risk.

Wetland 6 was classified in Group D (all wetlands in this group appear as man-made drainage ditches and have limited ecological receptors) and was not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.11.5 Human Health Risk Assessment**

##### **10.11.5.1 Samples Included**

###### **Sediment**

041M060101, 041M060201, 041M060301, 041M060401, 041M060501, 041M060601, 041M060701, 041M060801, 041M060901, 041M061001, 041M061101, 010M000101

###### **Surface Water**

041W060701, 041W061001

#### **10.11.5.2 Current and Future Land Use**

This wetland is the drainage pathway for the developed eastern part of NAS Pensacola. It is about one mile in length, and traverses the NAS Pensacola parade grounds and the western edge of the NATTC. It has no recreational, swimming, or fishing use, but is in an area where pedestrian traffic would have easy access. Numerous roads either parallel or cross Wetland 6 in several places, making the wetland easily accessible.

#### **10.11.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.11.5.4 Sediment COPCs**

As shown in Table 10-11-6, no sediment COPCs were identified.

#### **10.11.5.5 Surface Water COPCs**

As shown in Table 10-11-7, no surface water COPCs were identified.

#### **10.11.5.6 Risk Summary**

No COPCs were identified following the screening comparisons presented above. As a result, no formal human health risk assessment was conducted for Wetland 6.

#### **10.11.6 Conclusions and Recommendations**

Wetland 6 is a channelized drainage ditch without a viable aquatic community. In addition, this wetland is not considered a significant source of food or habitat. Therefore, as proposed in the approved RI/FS SAP Addendum, (EnSafe, 1997), this wetland was eliminated for further risk characterization. Since no COPCs were identified for Wetland 6, no formal HHRA was conducted. Because no excess ecological or human health risks are present at Wetland 6, no further action is recommended for this wetland.

TABLE 10-11-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland & Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Medium Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	Concentration Used for Screening	(2) Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Worker PRG	(5) Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
108883	Toluene	4.0000	J	14.0000	J	UG/KG	041M060901	3 / 12	12.00 - 15.00	8.00	14.00	N/A	63000000	98000000	N	N/A	BSL
109087	Chlorobenzene	2.0000	J	2.0000	J	UG/KG	041M060901	1 / 12	12.00 - 40.00	2.00	2.00	N/A	63000000	98000000	N	N/A	BSL
11096825	Aroclor-1260	9.8200	J	4.1000	J	UG/KG	041M061001	3 / 12	2.00 - 42.00	2.81	4.10	N/A	11000	6300	C	N/A	BSL
11097681	Aroclor-1254	9.5000	J	9.5000	J	UG/KG	041M060201	1 / 12	2.00 - 42.00	9.50	9.50	N/A	6300	6300	N	N/A	BSL
117840	Di-n-octyl phthalate	84.0000	J	84.0000	J	UG/KG	041M060801	1 / 11	390.00 - 590.00	84.00	84.00	N/A	63000000	98000000	N	N/A	BSL
127184	Tetrachloroethene	2.0000	J	4.0000	J	UG/KG	041M061101	2 / 12	12.00 - 40.00	3.00	4.00	N/A	430000	270000	C	N/A	BSL
129000	Pyrene	52.0000	J	100.0000	J	UG/KG	041M060601	4 / 11	40.00 - 590.00	73.60	100.00	N/A	95000000	150000000	N	N/A	BSL
181342	Benzo(g,h,i)perylene	29.0000	J	32.0000	J	UG/KG	041M060101	2 / 11	40.00 - 590.00	30.60	32.00	N/A	95000000	150000000	N	N/A	BSL
183398	Indene(1,2,3-cd)pyrene	27.0000	J	28.0000	J	UG/KG	010M000101	2 / 11	40.00 - 590.00	27.00	28.00	N/A	30000	19000	C	N/A	BSL
205992	Benzo(b)fluoranthene	27.0000	J	34.0000	J	UG/KG	041M060601	6 / 11	40.00 - 420.00	107.80	340.00	N/A	30000	19000	C	N/A	BSL
206440	Fluoranthene	42.0000	J	120.0000	J	UG/KG	041M060401	4 / 11	40.00 - 590.00	79.26	120.00	N/A	130000000	200000000	N	N/A	BSL
207089	Benzo(k)fluoranthene	21.0000	J	24.0000	J	UG/KG	041M060101	2 / 11	40.00 - 590.00	22.50	24.00	N/A	300000	190000	C	N/A	BSL
218019	Chrysene	21.0000	J	300.0000	J	UG/KG	041M060101	4 / 11	40.00 - 420.00	105.26	300.00	N/A	3000000	1900000	C	N/A	BSL
309902	Aldrin	0.3000	J	1.1000	J	UG/KG	041M060801	6 / 12	0.10 - 2.20	0.89	1.10	N/A	1300	810	C	N/A	BSL
319646	alpha-BHC	0.4800	J	0.8000	J	UG/KG	010M000101	2 / 12	0.10 - 2.20	0.64	0.80	N/A	3500	2200	C	N/A	BSL
319957	beta-BHC	0.1600	J	2.8000	J	UG/KG	010M000101	3 / 12	0.10 - 2.20	1.49	2.80	N/A	12000	7600	C	N/A	BSL
60293	4,4'-DDT	0.2200	J	260.0000	DJ	UG/KG	041M060801	11 / 12	0.20 - 0.20	31.71	260.00	N/A	65000	41000	C	N/A	BSL
60328	Benzo(a)pyrene	23.0000	J	42.0000	J	UG/KG	010M000101	4 / 11	40.00 - 590.00	32.50	42.00	N/A	3000	1900	C	N/A	BSL
5103719	alpha-Chlorodane	0.1800	J	1.7000	J	UG/KG	041M060601	6 / 12	0.10 - 2.20	0.84	1.70	N/A	63000	39000	C	N/A	BSL
5103742	gamma-Chlorodane	0.1900	J	1.2000	J	UG/KG	041M060601	6 / 12	0.10 - 2.20	0.52	1.20	N/A	63000	39000	C	N/A	BSL
56053	Benzo(a)anthracene	34.0000	J	43.0000	J	UG/KG	041M060101	3 / 11	40.00 - 590.00	39.00	43.00	N/A	30000	19000	C	N/A	BSL
60871	Dieldrin	0.2400	J	10.0000	J	UG/KG	010M000101	8 / 12	0.21 - 4.20	3.44	10.00	N/A	1400	860	C	N/A	BSL
67641	Acetone	13.0000	J	4000.0000	J	UG/KG	041M060601	7 / 12	12.00 - 570.00	743.86	4000.00	N/A	32000	49000000	N	N/A	BSL
71556	1,1,1-Trichloroethane	4.0000	J	4.0000	J	UG/KG	041M060301	1 / 12	12.00 - 40.00	4.00	4.00	N/A	63000000	98000000	N	N/A	BSL
72208	Endrin	1.8000	J	3.6000	J	UG/KG	010M000101	4 / 12	0.20 - 4.20	2.30	3.60	N/A	95000	150000	N	N/A	BSL
72543	4,4'-DDE	0.2300	J	110.0000	DJ	UG/KG	041M060701	11 / 12	0.22 - 0.22	21.17	110.00	N/A	65000	41000	C	N/A	BSL
7421934	Endrin aldehyde	0.4800	J	0.4800	J	UG/KG	041M060701	1 / 12	0.20 - 4.20	0.48	0.48	N/A	95000	150000	N	N/A	BSL
743954	Magnesium (Mg)	27.3000	J	1180.0000	J	MG/KG	041M060201	11 / 12	42.00 - 42.50	386.25	1180.00	N/A	N/A	N/A	N/A	NO	EN
743965	Manganese (Mn)	1.2000	J	35.2000	J	MG/KG	041M060801	11 / 12	1.20 - 1.20	13.19	35.20	N/A	15000	23000	N	N/A	BSL
743976	Mercury (Hg)	0.1100	J	0.1100	J	MG/KG	041M060701	1 / 12	0.03 - 0.08	0.11	0.11	N/A	95	150	N	N/A	BSL
7440020	Nickel (Ni)	0.8400	J	4.3000	J	MG/KG	041M060301	7 / 12	0.69 - 0.78	2.06	4.30	N/A	6300	9800	N	N/A	BSL
7440097	Potassium (K)	9.6000	J	161.0000	J	MG/KG	041M060401	11 / 12	158.00 - 158.00	65.08	161.00	N/A	N/A	N/A	N/A	NO	EN
7440224	Silver (Ag)	0.8900	J	0.8900	J	MG/KG	041M060401	1 / 12	0.23 - 0.88	0.89	0.89	N/A	1600	2500	N	N/A	BSL
7440235	Sodium (Na)	4.9000	J	105.0000	J	MG/KG	041M061101	9 / 12	2.40 - 10.00	33.93	105.00	N/A	N/A	N/A	N/A	NO	EN
7440280	Thallium (Tl)	0.6700	J	0.8800	J	MG/KG	041M060701	2 / 12	0.17 - 0.69	0.68	0.68	N/A	22	34	N	N/A	BSL
7440360	Antimony (Sb)	0.1600	J	0.3200	J	MG/KG	041M060801	2 / 12	0.12 - 3.80	0.24	0.32	N/A	130	200	N	N/A	BSL
7440362	Arsenic (As)	0.1400	J	2.1000	J	MG/KG	041M060801	9 / 12	0.12 - 0.71	0.70	2.10	N/A	15	9.2	C	N/A	BSL
7440393	Barium (Ba)	1.0000	J	37.0000	J	MG/KG	041M060501	11 / 12	2.40 - 2.40	9.54	37.00	N/A	22000	34000	N	N/A	BSL
7440417	Beryllium (Be)	0.1000	J	0.1400	J	MG/KG	041M060101	3 / 12	0.06 - 0.13	0.12	0.14	N/A	630	983	C	N/A	BSL
7440439	Cadmium (Cd)	0.1900	J	5.4000	J	MG/KG	041M060201	9 / 12	0.18 - 0.66	1.00	5.40	N/A	320	490	N	N/A	BSL
7440473	Chromium (Cr)	0.5600	J	73.5000	J	MG/KG	041M060201	11 / 12	1.80 - 1.80	15.58	73.50	N/A	950	1500	N	N/A	BSL
7440484	Cobalt (Co)	0.1800	J	20.7000	J	MG/KG	041M061001	7 / 12	0.19 - 0.29	3.53	20.70	N/A	19000	29000	N	N/A	BSL
7440508	Copper (Cu)	0.9700	J	48.2000	J	MG/KG	041M060301	11 / 12	2.40 - 2.40	13.04	48.20	N/A	13000	20000	N	N/A	BSL
7440568	Zinc (Zn)	9.7000	J	207.0000	J	MG/KG	041M060901	11 / 12	3.80 - 3.80	54.67	207.00	N/A	95000	150000	N	N/A	BSL
75003	Chloroethane	2.0000	J	2.0000	J	UG/KG	041M060901	1 / 12	12.00 - 40.00	2.00	2.00	N/A	76000000	4700	N	N/A	BSL
75343	1,1-Dichloroethane	9.0000	J	9.0000	J	UG/KG	041M060901	1 / 12	12.00 - 40.00	9.00	9.00	N/A	32000000	49000	N	N/A	BSL
75364	1,1-Dichloroethene	8.0000	J	8.0000	J	UG/KG	041M060901	1 / 12	12.00 - 40.00	8.00	8.00	N/A	37000	23000	C	N/A	BSL
76448	Heptachlor	0.1600	J	0.1600	J	UG/KG	041M060201	1 / 12	0.10 - 2.20	0.16	0.16	N/A	4900	3100	C	N/A	BSL
7782492	Selenium (Se)	0.8500	J	0.8500	J	MG/KG	041M060701	1 / 12	0.17 - 0.41	0.46	0.85	N/A	1600	2500	N	N/A	BSL
78016	Trichloroethene	2.0000	J	5.0000	J	UG/KG	041M060701	3 / 12	12.00 - 16.00	3.33	5.00	N/A	2000000	1300000	C	N/A	BSL
83328	Acenaphthene	34.0000	J	34.0000	J	UG/KG	041M060401	1 / 11	19.00 - 420.00	34.00	34.00	N/A	19000000	29000000	N	N/A	BSL
84682	Diethylphthalate	23.0000	J	23.0000	J	UG/KG	010M000101	1 / 11	390.00 - 590.00	23.00	23.00	N/A	250000000	390000000	N	N/A	BSL
84742	Di-n-butylphthalate	29.0000	J	99.0000	J	UG/KG	041M060101	4 / 11	400.00 - 690.00	57.26	99.00	N/A	32000000	49000000	N	N/A	BSL
85018	Phenanthrene	37.0000	J	51.0000	J	UG/KG	041M060101	2 / 11	40.00 - 590.00	44.00	51.00	N/A	9500000	15000000	N	N/A	BSL
85687	Butylbenzylphthalate	22.0000	J	30.0000	J	UG/KG	041M060901	6 / 11	400.00 - 590.00	26.17	30.00	N/A	63000000	98000000	N	N/A	BSL
72848	4,4'-DDD	0.2100	J	40.00	DJ	UG/KG	041M061101	12 / 12	NAV	12	40.00	N/A	92000	57000	C	N/A	BSL
7429906	Aluminum (Al)	313.0000	J	5980.00	J	MG/KG	041M060601	12 / 12	NAV	1861	5980.00	N/A	320000	490000	N	N/A	BSL
7440702	Calcium (Ca)	62.5000	J	8370.00	J	MG/KG	041M060101	12 / 12	NAV	2147	8370.00	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	328.0000	J	4320.00	J	MG/KG	041M061101	12 / 12	NAV	1335	4320.00	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	8.0000	J	147.00	J	MG/KG	041M060101	12 / 12	NAV	32	147.00	N/A	400	400	OSWER	NO	BSL
7440622	Vanadium (V)	0.6000	J	11.30	J	MG/KG	041M060101	12 / 12	NAV	3	11.30	N/A	2200	3400	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Minimum concentration used as screening value

(3) No background values were developed for this media

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report

(6) Rationale Codes Selection Reason:

Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrients (EN)

Definitions

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

**TABLE 10-11-7**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland & Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection	
71556	1,1,1-Trichloroethane	5		5		UG/L	041W061001	1 / 3	NAV	5	5	N/A	9000	24000	N	N/A	NO	BSL
75343	1,1-Dichloroethane	5		5		UG/L	041W061001	1 / 3	NAV	5	5	N/A	7300	18000	N	N/A	NO	BSL
75354	1,1-Dichloroethene	8		8		UG/L	041W060701	1 / 3	NAV	8	8	N/A	8.6	8.3	C	N/A	NO	BSL
7429905	Aluminum (Al)	287		406		UG/L	041W061001	2 / 3	NAV	347	406	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	15.9	J	30.5	J	UG/L	041W060701	2 / 3	NAV	23.2	30.5	N/A	8300	18000	N	N/A	NO	BSL
7440702	Calcium (Ca)	18300		24700		UG/L	041W061001	3 / 3	NAV	20700	24700	N/A	N/A	N/A	N/A	NO	EN	
57125	Cyanide (CN)	5.6	J	5.6	J	UG/L	041W061001	1 / 3	NAV	5.6	5.6	N/A	550	1600	N	N/A	NO	BSL
7439896	Iron (Fe)	334		870	J	UG/L	041W061001	3 / 3	NAV	527	870	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	1.2	J	3.1	J	UG/L	041W061001	2 / 3	NAV	2.2	3.1	N/A	15	15	TTAL	NO	BSL	
7439954	Magnesium (Mg)	1910	J	3480	J	UG/L	041W060701	3 / 3	NAV	2610	3480	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	19.5		55.7		UG/L	041W061001	3 / 3	NAV	36.2	55.7	N/A	2400	5000	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.88		0.88		UG/L	041W061001	1 / 3	NAV	0.88	0.88	N/A	36	76	N	N/A	NO	BSL
75092	Methylene chloride	13		13		UG/L	041W060701	1 / 3	NAV	13	13	N/A	1000	900	C	N/A	NO	BSL
7440097	Potassium (K)	1520	J	3050	J	UG/L	041W060701	3 / 3	NAV	2163	3050	N/A	N/A	N/A	N/A	NO	EN	
7440235	Sodium (Na)	10300		13800		UG/L	041W060301	3 / 3	NAV	11967	13800	N/A	N/A	N/A	N/A	NO	EN	
7440280	Thallium (Tl)	3.3	J	3.3	J	UG/L	041W060701	1 / 3	NAV	3.3	3.3	N/A	8.3	18	N	N/A	NO	BSL
79016	Trichloroethene	1		1		UG/L	041W061001	1 / 3	NAV	1	1	N/A	300	320	N	N/A	NO	BSL
7440622	Vanadium (V)	2.1	J	2.3		UG/L	041W061001	2 / 3	NAV	2.2	2.3	N/A	830	1800	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (B	3	J	3	J	UG/L	041W061001	1 / 3	NAV	3	3	N/A	110	130	C	N/A	NO	BSL
156592	cis-1,2-Dichloroethene	2		2		UG/L	041W061001	1 / 3	NAV	2	2	N/A	670	1700	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

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## **10.12 WETLAND 63A**

### **10.12.1 Site Description**

Wetland 63A is on the southeastern shoreline of Pensacola Bay, southeast of former Chevalier Field (now the NATTC). It receives storm water runoff from the southeastern side of the NATTC. Wetland 63A is bordered by Site 14 to the north, buildings and development to the west, a beach and picnic area to the south, and Pensacola Bay to the east.

Parsons and Pruitt described this area as an estuarine emergent system (USEPA, 1991). Wetland 63A appears to be fed by surface water runoff from the NATTC and the area immediately to the west. The open water portion of the wetland ranges from one to about three feet in depth. Surface water from Wetland 63A flows east through a drainage channel about three feet wide, and drains into Pensacola Bay. Sediment in the wetland is mostly sandy, with TOC levels below 1%. A small stand of pine trees is adjacent to Wetland 63A, but other vegetation around this wetland is generally associated with disturbed areas at NAS Pensacola.

The IR site potentially affecting Wetland 63A is Site 14 (Dredge Spoil Fill Area), which was created between 1975 and 1977 by deposition of spoils from dredging operations in Pensacola Bay. The berms surrounding Site 14 were later collapsed and the site was approved for no further action. Other sites which may have impacted Wetland 63A include the activities associated with Buildings 3383 and 2252, which were previously at the southeast corner of Chevalier Field, near Wetland 63A. These buildings were demolished before construction of the NATTC. In December of 1994, an IRA near Building 3380 excavated and treated soil which had been contaminated by a leak from the bilge water pipeline that ran to the west of Wetland 63A.

### **10.12.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-12-1 denotes Phase IIA Wetland 63A sampling locations.

## **Sediment**

Twenty metals were detected in Wetland 63A sediment samples. Four metals, including cadmium (7.7 ppm), chromium (92.5 ppm), lead (106 ppm), and mercury (0.14 ppb) exceeded sediment benchmark levels at location 63A3. Cadmium (0.70 ppm) and lead (32.1 ppm) also exceeded criteria at location 63A4. Ten pesticides were detected in Wetland 63A sediment samples, including 4,4'-DDT and its metabolites, delta/gamma-BHC, dieldrin, endrin, endosulfan sulfate, and alpha/gamma-chlordane. No 4,4'-DDT or its metabolites exceeded basewide levels (described in Section 6). Dieldrin exceeded its sediment benchmark criteria (0.715 ppb) at sample location 63A3 (4.1 ppb). The PCB Aroclor-1260 was also detected and exceeded its sediment benchmark criteria (21.6 ppb) at location 63A3 (260 ppb). Twelve SVOCs were detected in Wetland 63A sediment samples, including ten high- and low-molecular weight PAHs, and two phthalate esters. Fluoranthene exceeded its sediment benchmark level (113 ppb) at sample location 63A4 (130 ppb). No VOCs were detected in Wetland 63A sediment samples.

Table 10-12-1 shows the Wetland 63A Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-12-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-12-2. The HQs will be further discussed in the ecological risk section (Section 10.12.4).

## **Surface Water**

Fourteen metals were detected in Wetland 63A surface water samples. Aluminum (2,080 ppb), copper (5.0 ppb), iron (483 ppb) and lead (299 ppb) exceeded the respective surface water criteria for these metals at sample location 63A2. No organic constituents were detected in Wetland 63A surface water samples.



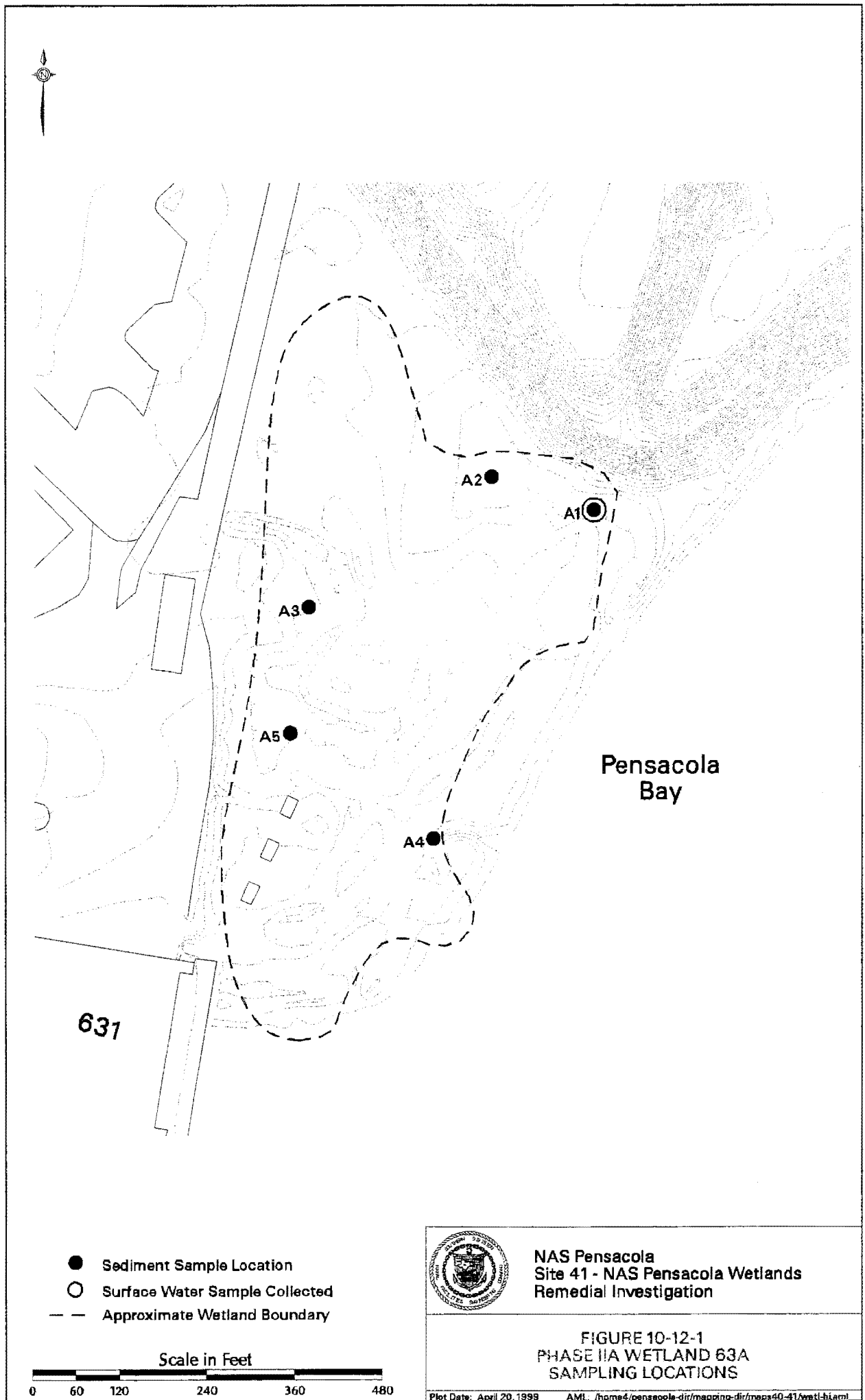


Table 10-12-1  
 Detected Concentrations in Wetland 63A Sediments  
 NAS Pensacola Site 41, Phase IIA

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	5/5	180 - 5500	2106.6
Antimony (Sb)	1/5	0.29	0.29
Arsenic (As)	5/5	0.15 - 1.4	0.65
Barium (Ba)	5/5	0.39 - 16.3	5.08
Cadmium (Cd)	3/5	0.15 - 7.7	2.85
Calcium (Ca)	5/5	1170 - 4040	2304
Chromium (Cr)	5/5	0.51 - 92.5	20.69
Cobalt (Co)	2/5	0.26 - 0.37	0.32
Copper (Cu)	5/5	0.38 - 15.1	4.77
Iron (Fe)	5/5	293 - 5000	1809.4
Lead (Pb)	5/5	0.93 - 106	28.85
Magnesium (Mg)	5/5	100 - 351	172.4
Manganese (Mn)	5/5	1.7 - 44.5	13.56
Mercury (Hg)	1/5	0.14	0.14
Nickel (Ni)	2/5	0.97 - 5.1	3.04
Potassium (K)	5/5	22 - 76	49.66
Silver (Ag)	1/4	0.46	0.46
Sodium (Na)	4/5	33.8 - 884	324.3
Vanadium (V)	5/5	0.55 - 14.4	4.76
Zinc (Zn)	5/5	1.5 - 88.9	26.04
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	3/5	0.32 - 5.6	2.41
4,4'-DDE	1/5	0.95	0.95
4,4'-DDT	3/5	0.29 - 1.1	0.72
Aroclor-1260	4/5	1.1 - 260	69.73
Dieldrin	1/5	4.1	4.1
Endosulfan sulfate	2/5	1.4	1.4
Endrin	1/5	2.7	2.7
alpha-Chlordane	1/5	1	1
delta-BHC	1/5	0.24	0.24
Gamma-BHC (Lindane)	1/5	0.21	0.21
gamma-Chlordane	1/5	1.4	1.4
<b>SVOCs (μg/kg)</b>			
Benzo(a)anthracene	1/5	63	63
Benzo(a)pyrene	1/5	72	72
Benzo(b)fluoranthene	1/5	120	120
Benzo(g,h,i)perylene	1/5	48	48
Benzo(k)fluoranthene	1/5	37	37
Butylbenzylphthalate	3/5	22 - 1400	494.33
Chrysene	1/5	74	74

Table 10-12-1  
 Detected Concentrations in Wetland 63A Sediments  
 NAS Pensacola Site 41, Phase IIA

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g/kg}</math>) (Continued)</b>			
Fluoranthene	1/5	130	130
Indeno(1,2,3-cd)pyrene	1/5	47	47
Phenanthrene	1/5	47	47
Pyrene	2/5	24 - 120	72
bis(2-Ethylhexyl)phthalate (BEHP)	2/5	99 - 130	114.5

**Note:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results were rejected. All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb) except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-12-3 shows the Wetland 63A Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-12-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only detected parameters with water quality criteria are presented in Table 10-12-4. The HQs will be further discussed in the ecological risk section (Section 10.12.4).

### 10.12.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data is lacking; thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-12-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-12-4.

**Table 10-12-2 (1)**  
**Wetland 63A**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M63A201</b>					
	4,4'-DDD (UG/KG)	1.3	1.22	1.07	b
	4,4'-DDE (UG/KG)	0.95	2.07	0.46	b
	4,4'-DDT (UG/KG)	0.29	1.19	0.24	b
	Aroclor-1260 (UG/KG)	14	21.8	0.68	b
	Arsenic (MG/KG)	0.15	7.24	0.02	a b
	Chromium (MG/KG)	2.2	52.3	0.04	a b
	Copper (MG/KG)	1.2	18.7	0.08	a b
	gamma-BHC (Lindane) (UG/KG)	0.21	0.32	0.66	b
	Lead (MG/KG)	3.1	30.2	0.10	a b
	Pyrene (UG/KG)	24	153	0.16	b
	Zinc (MG/KG)	4.9	124	0.04	a b

<b>041M63A401</b>					
	4,4'-DDD (UG/KG)	0.32	1.22	0.26	b
	4,4'-DDT (UG/KG)	0.78	1.19	0.66	b
	Antimony (MG/KG)	0.29	12	0.02	a

Notes:  
(a) USEPA Screening Concentration for Sediment - EPA SSVs  
(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
Some of the numbers in the table may vary because of rounding.

**Table 10-12-2 (2)**  
**Wetland 63A**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Aroclor-1260 (UG/KG)	1.1	21.5	0.05	ii
	Arsenic (MG/KG)	1.3	7.24	0.18	a b
	Benzo(a)anthracene (UG/KG)	63	74.0	0.84	b
	Benzo(a)pyrene (UG/KG)	72	88.8	0.81	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	130	182	0.71	b
	Cadmium (MG/KG)	0.7	0.68	1.03	b
	Chromium (MG/KG)	6.2	52.3	0.12	a b
	Chrysene (UG/KG)	74	108	0.69	b
	Copper (MG/KG)	4	18.7	0.21	a b
	Fluoranthene (UG/KG)	136	113	1.16	b
	Lead (MG/KG)	32.1	30.2	1.06	a b
	Nickel (MG/KG)	0.97	18.9	0.06	a b
	Phenanthrene (UG/KG)	47	86.7	0.54	b
	Pyrene (UG/KG)	120	153	0.78	b
	Zinc (MG/KG)	23.4	124	0.20	a b

1.1	1.3	63	72	130	0.7	6.2	74	4	136	32.1	0.97	47	120	23.4
21.5	7.24	74.0	88.8	182	0.68	52.3	108	18.7	113	30.2	18.9	86.7	153	124
0.05	0.18	0.84	0.81	0.71	1.03	0.12	0.69	0.21	1.16	1.06	0.06	0.54	0.78	0.20
ii	a b	b	b	b	b	a b	b	a b	b	a b	a b	b	b	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding

Table 10-12-3  
 Detected Concentrations in Wetland 63A Surface Water  
 NAS Pensacola Site 4I, Phase IIA

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	2080	2080
Arsenic (As)	1/1	5	5
Barium (Ba)	1/1	53.3	53.3
Calcium (Ca)	1/1	38700	38700
Copper (Cu)	1/1	5	5
Iron (Fe)	1/1	483	483
Lead (Pb)	1/1	299	299
Magnesium (Mg)	1/1	5740	5740
Manganese (Mn)	1/1	28.3	28.3
Potassium (K)	1/1	14700	14700
Selenium (Se)	1/1	8	8
Sodium (Na)	1/1	28300	28300
Vanadium (V)	1/1	4.1	4.1
Zinc (Zn)	1/1	19.3	19.3

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 63A through this pathway:

- Potential storm water runoff and sediment entrainment from Site 14, the former Chevalier Field complex including Sites 29 and UST G (a 1,000-gallon used oil and fuel tank associated with former NADEP Building 2662), and discharge from an NPDES-permitted outfall draining stormwater from the former Chevalier Field. During periods of storm surge, surface water from Pensacola Bay may breach the shore and enter the wetland as well.

Table 10-12-4 (1)

## Wetland 63A

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W63A201</b>	<b>Saltwater</b>					
	Aluminum	UG/L	2,080.0	1,500.0	1.38667	b
	Arsenic	UG/L	5.0	36.0	0.13889	a
	Copper	UG/L	5.0	2.9	1.72414	a b
	Iron	UG/L	483.0	300.0	1.61	b
	Lead	UG/L	299.0	5.6	53.39286	b
	Selenium	UG/L	8.0	71.0	0.11268	a b
	Zinc	UG/L	19.3	86.0	0.22442	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

**Table 10-12-5**  
**Calculated Sediment Screening Values for Wetland 63A**  
**NAS Pensacola Site 41**

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	<b>(ppb)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Cadmium	9.3 <sup>a, b</sup>	7.5E+01	69.9	7.7	NO
Chromium	50 <sup>a, b</sup>	1.9E+01	95.7	92.5	NO
Lead	5.6 <sup>b</sup>	9E+02	504	106	NO
Mercury	0.025 <sup>a, b</sup>	5.2E+01	0.13	0.14	YES
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDD	0.025 <sup>a</sup>	1.12E+04	2.8E+04	5.6	NO
Dieldrin	0.0019 <sup>a, b</sup>	2.39E+02	4.56E+01	4.1	NO
Total PCBs*	0.03 <sup>a, b</sup>	3.45E+03	1.04E+04	260	NO
Fluoranthene	1.6 <sup>a</sup>	1.2E+03	1.92E+05	130	NO

**Notes:**

\* = based on Aroclor-1260

Kd for organics calculated using foc of 0.0112 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class II Water Quality Criteria (1996).

The presence of sediment contaminants above benchmark values (see Table 10-12-5) validates the sediment transport pathway and by inference the surface water pathway. Additionally, there were four inorganics present in surface water above standards, further validating the pathway.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential source that would contribute contamination to Wetland 63 A through this pathway is the petroleum site UST G, Site 14, and Site 36.



#### *Sediment Leaching to Surface Water Pathway*

Groundwater at these sites has been shown to be contaminated, and therefore the pathway is considered valid.

#### **Transport within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that the wetland is self-enclosed. Surface water movement and sediment transport can therefore be considered to be relatively stable, and influenced only by influx during storm events.

Four organics — two pesticides, one PCB, and one semivolatile — and four inorganics, exceeded their benchmark values, but only one inorganic exceeded its calculated SSL. The source for inorganics and semivolatiles in sediment is likely associated with storm water drainage from former Chevalier Field, while pesticides are likely representative of residual from surface application near the wetland. There were four inorganics present in surface water above standards, none of which exceeded its SSL. The sources for these inorganics in surface water may be attributed to the surface water and groundwater pathways. Therefore, the sediment leaching pathway is considered valid for this wetland but is considered minor because only one parameter exceeded its SSL.

#### **Transport from the Wetland**

Due to the self-enclosed character of the wetland, surface water and sediment movement from Wetland 63A is considered to be stable and will remain within the wetland.

#### **10.12.4 Ecological Risk Assessment**

HQs for Wetland 63A sediment samples are presented in Table 10-12-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed HQs above 1 for

four metals, including cadmium (11.32), chromium (1.77), lead (3.51), and mercury (1.08) exceeded sediment benchmark levels at location 63A3. Cadmium (1.03) and lead (1.06) also had HQs greater than 1 at location 63A4. Pesticides with HQs above 1 included 4,4'-DDD at sample locations 63A2 (1.07) and 63A3 (4.59). However, as noted in the nature and extent discussion, these concentrations of 4,4'-DDT and its metabolites were below basewide levels. Dieldrin also had a HQ above 1 at sample location 63A3 (5.69), as did the PCB Aroclor-1260 (12.04). Fluoranthene had a HQ greater than 1 at sample location 63A4 (1.15). Phase IIA surface water results revealed HQs above 1 for aluminum (1.39), copper (1.72), iron (1.61) and lead (53.39) at sample location 63A2. HQs greater than one indicate a potential for excess risk.

Wetland 63A was classified in Group C and was not sampled in Phase IIB based on Phase IIA data. Wetlands 16 and 18 were chosen to represent Group C because they had the highest levels of contamination compared to other Group C Wetlands. Color-codes, groupings and rationale for classification are described in Section 7.

Risk in Wetland 16 was evaluated with respect to one assessment endpoint, survival, growth, and reproduction of macroinvertebrates associated with the benthic environment. Decision making triad results for Phase IIB/III Wetland 16 sediment analytical results (condition number 2) indicated that Wetland 16 sediment was acceptable and no further action was recommended for this medium.

Risk in Wetland 18 assessment endpoints were piscivorous bird health and reproduction; survival, growth, and reproduction of macroinvertebrates associated with the benthic environment; and protection of fish viability. Decision making triad results for Wetland 18 Phase IIB/III sediment and surface water analytical results (both condition number 3) indicated that Wetland 18 sediment and surface water were acceptable and no further action was recommended for either media at Wetland 18.

## **10.12.5 Human Health Risk Assessment**

### **10.12.5.1 Samples Included**

#### **Sediment**

041M63A101, 041M63A201, 014M63A301, 041M63A401, 014M63A501

#### **Surface Water**

041W63A201

### **10.12.5.2 Current and Future Land Use**

Wetland 63A is southeast of the NATTC, directly east of the NATTC's Enlisted Club, a recreational club for NATTC students. A picnic ground containing covered pavilions is south of the Wetland 63A area. No signs or barriers exist to keep trespassers from the area. However, Wetland 63A is densely covered with weeds and scrubby vegetation, and is not an area that would be attractive to sightseers or passersby. It is unlikely that people would trespass through the area on a frequent basis, and the area is not regularly maintained by maintenance workers.

### **10.12.5.3 Fish COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

### **10.12.5.4 Sediment COPCs Identified**

As shown in Table 10-12-6, no sediment COPCs were identified.

### **10.12.5.5 Surface Water COPCs Identified**

As shown in Table 10-12-7, the following chemical was identified as a COPC:

- Lead

**TABLE 10-12-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 53a Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	0.3200	J	5.6000	DJ	UG/KG	041M63A301	3 / 5	0.20 - 0.22	2.4	5.60	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	0.9500		0.9500		UG/KG	041M63A401	1 / 5	0.20 - 0.22	1.0	0.95	N/A	65000	1900	C	N/A	NO	BSL
50293	4,4'-DDT	0.2900	J	1.1000	J	UG/KG	041M63A301	3 / 5	0.20 - 0.22	0.7	1.10	N/A	65000	1900	C	N/A	NO	BSL
5103719	alpha-Chlordane	1.0000	J	1.0000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	1.0	1.00	N/A	63000	1800	C	N/A	NO	BSL
7429905	Aluminum (Al)	180.0000	J	6740.00		MG/KG	041M63A301	6 / 6	NAV	2878.8	6740.00	N/A	320000	7800	N	N/A	NO	BSL
7440360	Antimony (Sb)	0.2900	J	12.6000	J	MG/KG	041M63A301	2 / 6	0.20 - 0.22	6.4	12.60	N/A	130	3.1	N	N/A	NO	BSL
11096825	Aroclor-1260	1.1000	J	260.0000	DJ	UG/KG	041M63A201	4 / 5	0.20 - 0.22	69.7	260.00	N/A	11000	320	C	N/A	NO	BSL
7440382	Arsenic (As)	0.1500	J	1.40		MG/KG	041M63A401	6 / 6	NAV	0.7	1.40	N/A	15	0.43	C	N/A	NO	BSL
7440393	Barium (Ba)	0.3900	J	22.00	J	MG/KG	041M63A101	6 / 6	NAV	7.9	22.00	N/A	22000	550	N	N/A	NO	BSL
56553	Benzo(a)anthracene	63.0000		63.0000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	63.0	63.00	N/A	30000	880	C	N/A	NO	BSL
50328	Benzo(a)pyrene	72.0000		72.0000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	72.0	72.00	N/A	3000	88	C	N/A	NO	BSL
205992	Benzo(b)fluoranthene	120.0000		120.0000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	120.0	120.00	N/A	30000	880	C	N/A	NO	BSL
191242	Benzo(g,h,i)perylene	48.0000	J	48.0000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	48.0	48.00	N/A	9500000	230000	N	N/A	NO	BSL
207089	Benzo(k)fluoranthene	37.0000	J	37.0000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	37.0	37.00	N/A	300000	8800	C	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	99.0000	J	130.0000	J	UG/KG	041M63A401	2 / 5	0.20 - 0.22	114.5	130.00	N/A	1600000	46000	C	N/A	NO	BSL
85687	Butylbenzylphthalate	22.0000	J	1400.0000	J	UG/KG	041M63A401	3 / 5	0.20 - 0.22	494.3	1400.00	N/A	63000000	1600000	N	N/A	NO	BSL
7440439	Cadmium (Cd)	0.1500	J	7.7000		MG/KG	041M63A301	4 / 6	0.20 - 0.22	3.7	7.70	N/A	320	7.8	N	N/A	NO	BSL
7440702	Calcium (Ca)	1170.0000		4040.00	J	MG/KG	041M63A401	6 / 6	NAV	2316.7	4040.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	0.5100	J	92.50		MG/KG	041M63A301	6 / 6	NAV	27.7	92.50	N/A	1600	23	N	N/A	NO	BSL
218019	Chrysene	74.0000		74.0000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	74.0	74.00	N/A	3000000	88000	C	N/A	NO	BSL
7440484	Cobalt (Co)	0.2600	J	0.3700	J	MG/KG	041M63A401	2 / 6	0.20 - 0.22	0.3	0.37	N/A	19000	470	N	N/A	NO	BSL
7440508	Copper (Cu)	0.3800	J	15.10		MG/KG	041M63A101	6 / 6	NAV	6.4	15.10	N/A	13000	310	N	N/A	NO	BSL
319868	delta-BHC	0.2400	J	0.2400	J	UG/KG	041M63A201	1 / 5	0.20 - 0.22	0.2	0.24	N/A	12000	350	C	N/A	NO	BSL
60571	Dieldrin	4.1000	J	4.1000	J	UG/KG	041M63A301	1 / 5	0.20 - 0.22	4.1	4.10	N/A	1400	40	C	N/A	NO	BSL
1031078	Endosulfan sulfate	1.4000	J	1.4000	J	UG/KG	041M63A401	2 / 5	0.20 - 0.22	1.4	1.40	N/A	1900000	47000	N	N/A	NO	BSL
72208	Endrin	2.7000	J	2.7000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	2.7	2.70	N/A	95000	2300	N	N/A	NO	BSL
206440	Fluoranthene	130.0000		130.0000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	130.0	130.00	N/A	13000000	310000	N	N/A	NO	BSL
58899	gamma-BHC (Lindane)	0.2100	J	0.2100	J	UG/KG	041M63A201	1 / 5	0.20 - 0.22	0.2	0.21	N/A	17000	490	C	N/A	NO	BSL
5103742	gamma-Chlordane	1.4000		1.4000		UG/KG	041M63A401	1 / 5	0.20 - 0.22	1.4	1.40	N/A	63000	1800	C	N/A	NO	BSL
193395	Indeno(1,2,3-cd)pyrene	47.0000	J	47.0000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	47.0	47.00	N/A	30000	880	C	N/A	NO	BSL
7439896	Iron (Fe)	293.0000		5000.00		MG/KG	041M63A301	6 / 6	NAV	2169.5	5000.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	0.9300		106.0000		MG/KG	041M63A301	5 / 6	0.20 - 0.22	28.8	106.00	N/A	400	400		OSWER	NO	BSL
7439954	Magnesium (Mg)	100.0000	J	351.00	J	MG/KG	041M63A301	6 / 6	NAV	202.2	351.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	1.7000		44.50		MG/KG	041M63A101	6 / 6	NAV	15.2	44.50	N/A	15000	1100	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.1400	J	0.1400	J	MG/KG	041M63A301	1 / 6	0.20 - 0.22	0.1	0.14	N/A	95	2.3	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.9700	J	7.3000	J	MG/KG	041M63A301	3 / 6	0.20 - 0.22	4.5	7.30	N/A	6300	160	N	N/A	NO	BSL
85018	Phenanthrene	47.0000	J	47.0000	J	UG/KG	041M63A401	1 / 5	0.20 - 0.22	47.0	47.00	N/A	9500000	230000	N	N/A	NO	BSL
7440097	Potassium (K)	22.0000	J	335.00	J	MG/KG	041M63A501	6 / 6	NAV	97.2	335.00	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	24.0000	J	120.0000		UG/KG	041M63A401	2 / 5	0.20 - 0.22	72.0	120.00	N/A	9500000	230000	N	N/A	NO	BSL
7440224	Silver (Ag)	0.4600	J	0.4600	J	MG/KG	041M63A301	1 / 6	0.20 - 0.22	0.5	0.46	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	33.8000	J	884.0000		MG/KG	041M63A201	5 / 6	0.20 - 0.22	324.3	884.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	0.5500	J	14.40		MG/KG	041M63A101	6 / 6	NAV	6.2	14.40	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	1.5000		110.00		MG/KG	041M63A401	6 / 6	NAV	40.0	110.00	N/A	95000	2300	N	N/A	NO	EN

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(6) Rationale Codes Selection Reason:

Deletion Reason:  
Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-12-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 63A Surface Water

CAS Number	Chemical	(1)		(1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2)		(3)		(4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Tap Water RBC				
7429905	Aluminum (Al)	2080		2080		UG/L	041W63A201	1 / 1	NAV	2080	2080	N/A	120000	3700	N	N/A	NO	BSL
7440382	Arsenic (As)	5	J	5	J	UG/L	041W63A201	1 / 1	NAV	5	5	N/A	5.6	0.045	C	N/A	NO	BSL
7440393	Barium (Ba)	53.3	J	53.3	J	UG/L	041W63A201	1 / 1	NAV	53.3	53.3	N/A	8300	260	N	N/A	NO	BSL
7440702	Calcium (Ca)	38700		38700		UG/L	041W63A201	1 / 1	NAV	38700	38700	N/A	N/A	N/A	N	N/A	NO	EN
7440508	Copper (Cu)	5	J	5	J	UG/L	041W63A201	1 / 1	NAV	5	5	N/A	4800	150	N	N/A	NO	BSL
7439896	Iron (Fe)	483		483		UG/L	041W63A201	1 / 1	NAV	483	483	N/A	N/A	N/A	N	N/A	NO	EN
7438921	Lead (Pb)	299		299		UG/L	041W63A201	1 / 1	NAV	299	299	N/A	15	15	TTAL	YES	ASL	
7439954	Magnesium (Mg)	5740		5740		UG/L	041W63A201	1 / 1	NAV	5740	5740	N/A	N/A	N/A	N	N/A	NO	EN
7439965	Manganese (Mn)	28.3		28.3		UG/L	041W63A201	1 / 1	NAV	28.3	28.3	N/A	2400	73	N	N/A	NO	BSL
7440097	Potassium (K)	14700		14700		UG/L	041W63A201	1 / 1	NAV	14700	14700	N/A	N/A	N/A	N	N/A	NO	EN
7782492	Selenium (Se)	8		8		UG/L	041W63A201	1 / 1	NAV	8	8	N/A	600	18	N	N/A	NO	BSL
7440235	Sodium (Na)	28300		28300		UG/L	041W63A201	1 / 1	NAV	28300	28300	N/A	N/A	N/A	N	N/A	NO	EN
7440622	Vanadium (V)	4.1	J	4.1	J	UG/L	041W63A201	1 / 1	NAV	4.1	4.1	N/A	830	26	N	N/A	NO	BSL
7440688	Zinc (Zn)	19.3	J	19.3	J	UG/L	041W63A201	1 / 1	NAV	19.3	19.3	N/A	36000	1100	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Detection Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### 10.12.5.6 Risk Characterization

##### *Lead Risk Characterization*

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 63A. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 63A surface water was addressed as an additional exposure relative to typical exposures encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the lead model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 63A. The assumption was made that this child would incidentally ingest 0.05 liters of surface water during each visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 63A surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of 229  $\mu\text{g/L}$ , the annual alternate source exposure was estimated to be 1.63  $\mu\text{g}$  lead/day.

Table 10-12-8 presents the Lead Model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-12-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 2.8  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.33%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, surface water lead concentrations at Wetland 63A would not require specific action under the hypothetical exposure scenario.

Final Remedial Investigation Report  
 NAS Pensacola Site 4I  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-12-8  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 63A  
 Pensacola, Florida

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100  $\mu\text{g Pb/m}^3$  DEFAULT  
 Indoor AIR Pb Conc: 30.0 percent of outdoor.  
 Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb/L}$  DEFAULT  
 WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.  
 Dust: constant conc.

Age	Soil ( $\mu\text{g Pb/g}$ )	House Dust ( $\mu\text{g Pb/g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

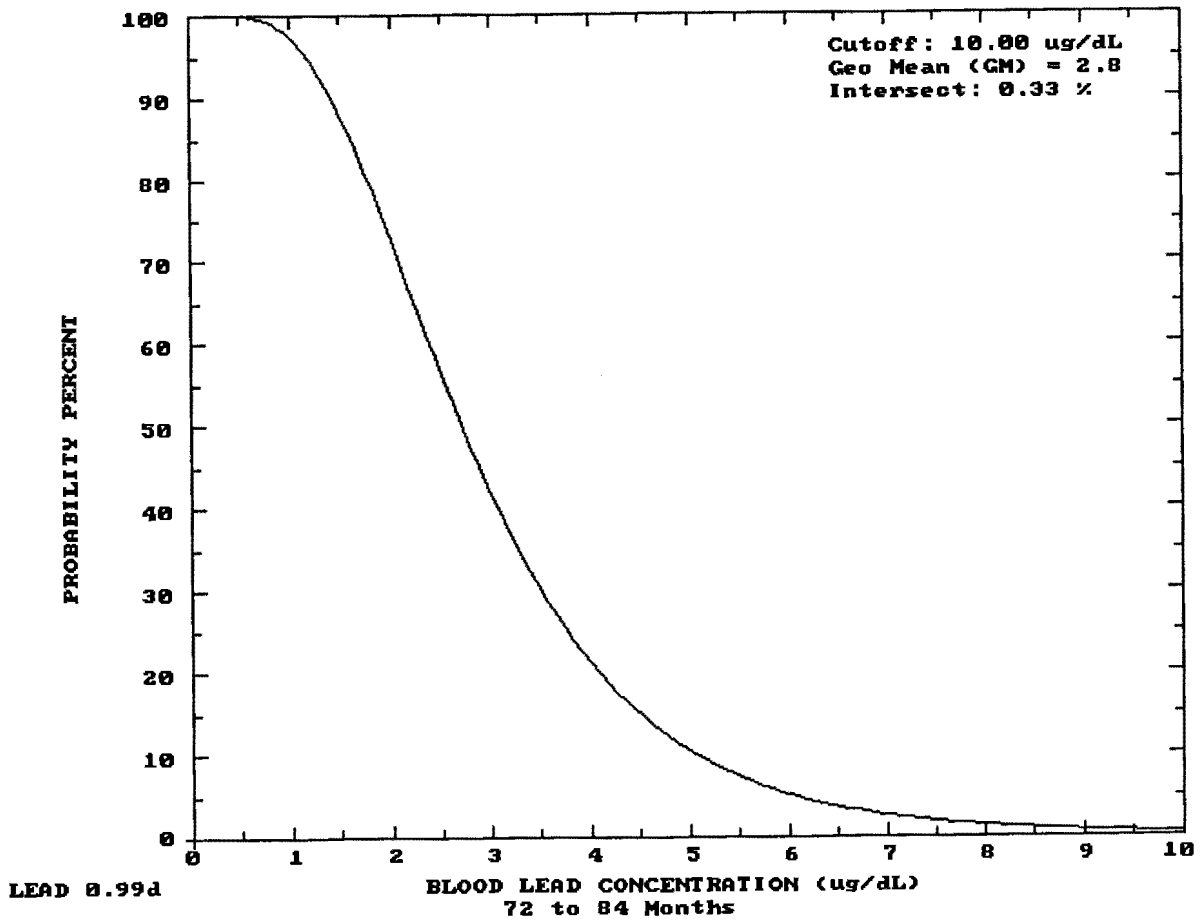
Alternative Source Intake: Wetland 63A surface water  
 6-7: 1.63  $\mu\text{g Pb/day}$

MATERNAL CONTRIBUTION: Infant Model  
 Maternal Blood Conc: 2.50  $\mu\text{g Pb/dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g/dL}$ )	Total Uptake ( $\mu\text{g/day}$ )	Soil + Dust Uptake ( $\mu\text{g/day}$ )	Diet Uptake ( $\mu\text{g/day}$ )	Water Uptake ( $\mu\text{g/day}$ )	Alt. Source Uptake ( $\mu\text{g/day}$ )	Air Uptake ( $\mu\text{g/day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	2.8	10.22	4.87	3.35	1.13	0.78	0.09

Figure 10-12-2      Probability Percentage of Blood Lead Levels for the Hypothetical Child  
Receptor





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#### **10.12.5.7 Remedial Goal Options**

No COCs were identified for Wetland 63A, and as a result, no RGOs were calculated.

#### **10.12.6 Conclusions and Recommendations**

Because they had similar contaminants (metals and pesticides/PCBs), Wetlands 16 and 18 were sampled to represent the Group C wetlands in Phase IIB/III. Phase IIB/III assessment endpoint and triad analyses revealed that sediment and surface water were acceptable at these wetlands. The HHRA identified no sediment or fish tissue COPCs at Wetland 63A.

Because of the lack of excess ecological and human health risk at Wetland 63A, no further action is recommended for Wetland 63A.

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## **10.13 WETLAND 48**

### **10.13.1 Site Description**

Wetland 48 is in a mostly undeveloped portion of NAS Pensacola, north of Radford Boulevard, and south of the NAS Pensacola Fuel Farm. It is a thickly vegetated palustrine forested wetland. Parsons and Pruitt described this area as a palustrine forested system (USEPA, 1991). Wetland 48 appears to be fed by surface water and groundwater sources. Surface water drains to the east into Wetland 52, passing through a culvert under the access road to the fuel farm. A sediment sample collected in this area was mostly sandy, with a TOC value of 4.4%.

The IR site potentially affecting Wetland 48 is Site 37 (Sherman Field Fuel Farm Area), south of the western end of Forrest Sherman Field.

### **10.13.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-13-1 denotes the Phase IIA Wetland 48 sampling location.

#### **Sediment**

Fifteen metals were detected in the single sediment sample collected at Wetland 48. No metals exceeded a sediment benchmark level at Wetland 48. 4,4'-DDD (2,600 ppb), 4,4'-DDE (620 ppb), and 4,4'-DDT (240 ppb) were detected in the Wetland 48 sediment sample above basewide levels (20 ppb, 40 ppb, and 50 ppb, respectively). No other organics were detected in the Wetland 48 sediment sample.

Table 10-13-1 shows the Wetland 48 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-13-2 compares detected concentrations to sediment benchmark levels, and lists calculated HQs for each parameter.

The HQs will be further discussed in the ecological risk section (Section 10.13.4). Only the parameters with benchmark levels are presented in Table 10-13-2.

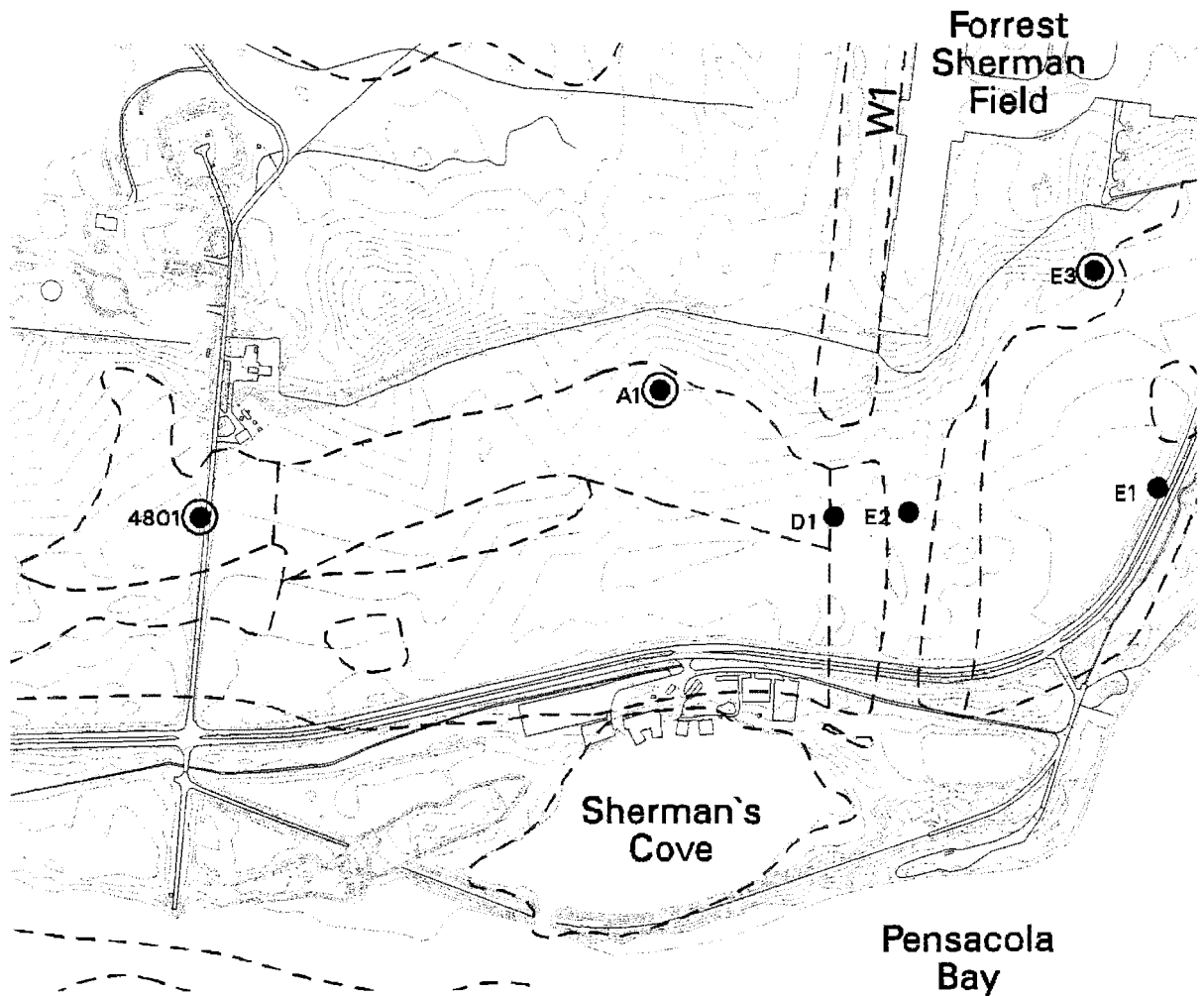
### **Surface Water**

Five metals were detected in the single Wetland 48 surface water sample. None of the detected metals exceeded surface water quality criteria. No organic constituents were detected in Wetland 48 surface water.

Table 10-13-3 shows the Wetland 48 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-13-4 which lists only the parameters with surface water criteria, compares detected concentrations at each sample location to surface water quality criteria, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.13.4).

### **10.13.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking, thus the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-13-5 presents those contaminants present in sediment above benchmark values and their calculated SSLs. Contaminants present in surface water were presented previously in Table 10-13-4.



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

FIGURE 10-13-1  
PHASE IIA WETLAND 48 & 52  
SAMPLING LOCATIONS

**Table 10-13-1**  
**Phase IIA Detected Concentrations in Wetland 48 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	1/1	1400	1400
Arsenic (As)	1/1	0.55	0.55
Barium (Ba)	1/1	3.5	3.5
Cadmium (Cd)	1/1	0.3	0.3
Calcium (Ca)	1/1	499	499
Chromium (Cr)	1/1	1.1	1.1
Copper (Cu)	1/1	1.1	1.1
Iron (Fe)	1/1	290	290
Lead (Pb)	1/1	17.4	17.4
Magnesium (Mg)	1/1	84.9	84.9
Manganese (Mn)	1/1	1.5	1.5
Potassium (K)	1/1	14.4	14.4
Selenium (Se)	1/1	0.71	0.71
Vanadium (V)	1/1	2.4	2.4
Zinc (Zn)	1/1	6.3	6.3
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	1/1	2600	2600
4,4'-DDE	1/1	620	620
4,4'-DDT	1/1	240	240

**Note:**

All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb) except for metals which are in milligrams per kilogram (µg/kg) or parts per million (ppm).

**Table 10-13-2**  
**Wetland 48**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M480101</b>					
	4,4'-DDD (UG/KG)	2600 DJ	1.22	2131.15	b
	4,4'-DDE (UG/KG)	620 DJ	2.07	299.52	b
	4,4'-DDT (UG/KG)	240 J	1.19	201.68	b
	Arsenic (MG/KG)	0.55 J	7.24	0.08	a b
	Cadmium (MG/KG)	0.3 J	0.68	0.44	b
	Chromium (MG/KG)	1.1	52.3	0.02	a b
	Copper (MG/KG)	1.1 J	18.7	0.06	a b
	Lead (MG/KG)	17.4	30.2	0.58	a b
	Zinc (MG/KG)	6.3	124	0.05	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.



Table 10-13-3  
 Phase IIA Detected Concentrations in Wetland 48 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Calcium (Ca)	1/1	977	977
Iron (Fe)	1/1	285	285
Magnesium (Mg)	1/1	1020	1020
Manganese (Mn)	1/1	2.9	2.9
Sodium (Na)	1/1	7480	7480

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

**Table 10-13-4 (1)**  
**Wetland 48**  
**Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W480101</b>	<b>Freshwater</b>					
Iron		UG/L	285.0	1,000.0	0.285	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

**Table 10-13-5**  
**Calculated Sediment Screening Values for Wetland 48**

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Organics (ppb)</b>					
4,4 DDE	10.5 <sup>a</sup>	1.96E+05	2.06E+08	620	NO
4,4 DDD	0.0064 <sup>a</sup>	4.38E+04	2.8E+04	2,600	NO
4,4 DDT	0.001 <sup>a, b</sup>	1.15E+05	1.15E+04	240	NO

**Notes:**

Kd for organics calculated using foc of 0.0443 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 48 through this pathway:

- Potential stormwater water runoff and sediment entrainment from the petroleum site UST X (a fuel tank of unknown size/quantity), from the marina operations along Radford Blvd. paralleling the southern boundary of the base with Pensacola Bay and along Radford Blvd. itself. During periods of storm surge, surface water from Pensacola Bay may breach Radford Blvd. and enter the wetland complex as well.

The presence of sediment contaminants above benchmark values (see Table 10-13-5) validates the sediment transport pathway and by inference the surface water pathway. However, there were no surface water contaminants present above standards, thus the surface water pathway is considered invalid.

#### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the primary potential source that would contribute contamination to Wetland 48 through this pathway is the petroleum site UST X. Groundwater at this site has been shown to be contaminated, and therefore the pathway is considered valid.

#### **Transport within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

The configuration of wetland, along with landform analysis, indicates that wetland is connected to Wetlands 52 and 74, and the direction of overall flow is inferred to be to the east towards Wetland 74. During periods of high water, the flow through the Wetland 48/52/74 complex is towards the east and southeast, eventually emptying into the Bay to the east of Wetland 52, and to the south of Wetland 48 near the marina area. Surface water movement and sediment transport can therefore be considered to be mobile and subject only to surface water influx during rain events, stormwater surges from the Bay, and overall drainage to the Bay.

##### *Sediment Leaching to Surface Water Pathway*

Three organics, all pesticides, exceeded their benchmark values, but did not exceed their calculated SSL. There were no contaminants present in surface water above standards. Therefore, the sediment leaching pathway is considered invalid for this wetland, and sediment contamination is not expected to partition to surface water.

#### **Transport from the Wetland**

Surface water and sediment movement from Wetland 48 follows drainage into Wetlands 52 and 74, and drainage towards the Bay in the marina area.

#### **10.13.4 Ecological Risk Assessment**

HQs for Wetland 48 sediment samples are presented in Table 10-13-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for 4,4'-DDD (2,131.5), 4,4'-DDE (299.52), and 4,4'-DDT (201.68). Phase IIA surface water results revealed no HQs above 1 for the single surface water sample collected at Wetland 48. HQs greater than one indicate a potential for excess risk.

Wetland 48 was classified as Group E. Because aquatic and terrestrial receptors were not expected, Group E wetlands were not sampled in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.13.5 Human Health Risk Assessment**

##### **10.13.5.1 Samples Included**

###### **Sediment**

041M480101

###### **Surface Water**

041W480101

##### **10.13.5.2 Current and Future Land Use**

Wetland 48 is in a densely wooded zone south of the NAS Pensacola Fuel Farm. Though the area is not posted as restricted, it is in an area of the base that is not regularly frequented by personnel, and is not easily accessible. Though the access road to the fuel farm provides accessibility to Wetland 48's eastern fringe, no hiking trails or roads exist which would facilitate recreational use. The dense foliage in the wetland also serves as a barrier to trespassers.

#### **10.13.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.13.5.4 Sediment COPCs**

As shown in Table 10-13-6, no sediment COPCs were identified.

#### **10.13.5.5 Surface Water COPCs**

As shown in Table 10-13-7, no surface water COPCs were identified.

#### **10.13.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 48.

#### **10.13.6 Conclusions and Recommendations**

Wetland 48 is intermittent, and due to its location is not expected to be a significant source of food, water, or habitat. Therefore, as proposed in the approved RI/FS SAP Addendum (EnSafe, 1997), this wetland was eliminated from further risk characterization. Since no COPCs were identified for Wetland 48, no formal HHRA was conducted. No further action is recommended for this wetland.

TABLE 10-13-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 48 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	2600.0000	DJ	2600.0000	DJ	UG/KG	041M480101	1 / 1	2600.00 - 2600.00	2600.00	2600	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	620.0000	DJ	620.0000	DJ	UG/KG	041M480101	1 / 1	620.00 - 620.00	620.00	620	N/A	65000	1900	C	N/A	NO	BSL
50293	4,4'-DDT	240.0000	J	240.0000	J	UG/KG	041M480101	1 / 1	240.00 - 240.00	240.00	240	N/A	65000	1900	C	N/A	NO	BSL
7429905	Aluminum (Al)	1400.0000		1400.0000		MG/KG	041M480101	1 / 1	1400.00 - 1400.00	1400.00	1400	N/A	320000	7800	N	N/A	NO	BSL
7440382	Arsenic (As)	0.5500	J	0.5500	J	MG/KG	041M480101	1 / 1	0.55 - 0.55	0.55	0.55	N/A	15	0.43	C	N/A	NO	BSL
7440393	Barium (Ba)	3.5000	J	3.5000	J	MG/KG	041M480101	1 / 1	3.50 - 3.50	3.50	3.5	N/A	22000	550	N	N/A	NO	BSL
7440439	Cadmium (Cd)	0.3000	J	0.3000	J	MG/KG	041M480101	1 / 1	0.30 - 0.30	0.30	0.3	N/A	320	7.8	N	N/A	NO	BSL
7440473	Chromium (Cr)	1.1000		1.1000		MG/KG	041M480101	1 / 1	1.10 - 1.10	1.10	1.1	N/A	950	23	N	N/A	NO	BSL
7440508	Copper (Cu)	1.1000	J	1.1000	J	MG/KG	041M480101	1 / 1	1.10 - 1.10	1.10	1.1	N/A	13000	310	N	N/A	NO	BSL
7439896	Iron (Fe)	290.0000		290.0000		MG/KG	041M480101	1 / 1	290.00 - 290.00	290.00	290	N/A	N/A	N/A		N/A	NO	EN
7439921	Lead (Pb)	17.4000		17.4000		MG/KG	041M480101	1 / 1	17.40 - 17.40	17.40	17.4	N/A	400	400		OSWER	NO	BSL
7439954	Magnesium (Mg)	84.9000	J	84.9000	J	MG/KG	041M480101	1 / 1	84.90 - 84.90	84.90	84.9	N/A	N/A	N/A		N/A	NO	EN
7439965	Manganese (Mn)	1.5000		1.5000		MG/KG	041M480101	1 / 1	1.50 - 1.50	1.50	1.5	N/A	15000	1100	N	N/A	NO	BSL
7440097	Potassium (K)	14.4000	J	14.4000	J	MG/KG	041M480101	1 / 1	14.40 - 14.40	14.40	14.4	N/A	N/A	N/A		N/A	NO	EN
7440622	Vanadium (V)	2.4000	J	2.4000	J	MG/KG	041M480101	1 / 1	2.40 - 2.40	2.40	2.4	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	6.3000	J	6.3000	J	MG/KG	041M480101	1 / 1	6.30 - 6.30	6.30	6.3	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section B of this report.

(5) Residential soil RBCs presented in Region II Risk-Based Concentration Tables, (USEPA, 1998).

(6) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Detection Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

TABLE 10-13-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 48 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	(3) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(4) Rationale for Contaminant Detection or Selection
7440702	Calcium (Ca)	977.00	J	977.00	J	UG/L	041W480101	1 / 1	NAV	977.00	977	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	285.00		285.00		UG/L	041W480101	1 / 1	NAV	285.00	285	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	1020.00	J	1020.00	J	UG/L	041W480101	1 / 1	NAV	1020.00	1020	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	2.90	J	2.90	J	UG/L	041W480101	1 / 1	NAV	2.90	2.9	N/A	2400	73	N	N/A	BSL
7440235	Sodium (Na)	7480.00		7480.00		UG/L	041W480101	1 / 1	NAV	7480.00	7480	N/A	N/A	N/A	N/A	NO	EN

(1) Minimum/maximum detected concentration

(2) Minimum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1989).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Detection Reason: Below Screening Levels (BSL)  
Background Levels (BKQ)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic



## **10.14 WETLAND 49**

### **10.14.1 Site Description**

Wetland 49 is located southwest of Forested Sherman Field. Parsons and Pruitt described this area as a palustrine forested system (USEPA, 1991). Wetland 49 is surrounded to the north and east by the grassy fields bordering the fringes of the Forrest Sherman Field runways, which are periodically mowed. To the south is a wooded zone containing mostly scrub oaks and pines. The forested area of Wetland 49 contains pines and cypress trees. The northern fringe of the wetland is more seasonally wet than the drier southern portion. A shallow sheet flow of water in the northern portion drains to the north toward storm sewer grates along the wetland's fringe. An open water portion at the south end of Wetland 49 ranges from zero to about one foot in depth and from five to twenty feet in width. A clearing at the southeast end of the wetland also is seasonally inundated during wet weather.

Wetland 49 is west of UST 18 (Crash Crew Training Area), to the northeast of Site 37 (Sherman Field Fuel Farm Area), and is partially encompassed by Site 19 (Fuel Farm Pipeline Leak). Site 19 resulted from a 1958 aviation fuel leak from the underground pipeline leading from the fuel farm across Wetland 49 to Forrest Sherman Field. The leak occurred near the Wetland 49 area.

### **10.14.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-14-1 denotes the Phase IIA Wetland 49 sampling location.

### **Sediment**

Seventeen metals were detected in Wetland 49 sediment samples, and did not exceed sediment benchmark levels. Pesticides detected in Wetland 49 sediment samples include 4,4'-DDT and its

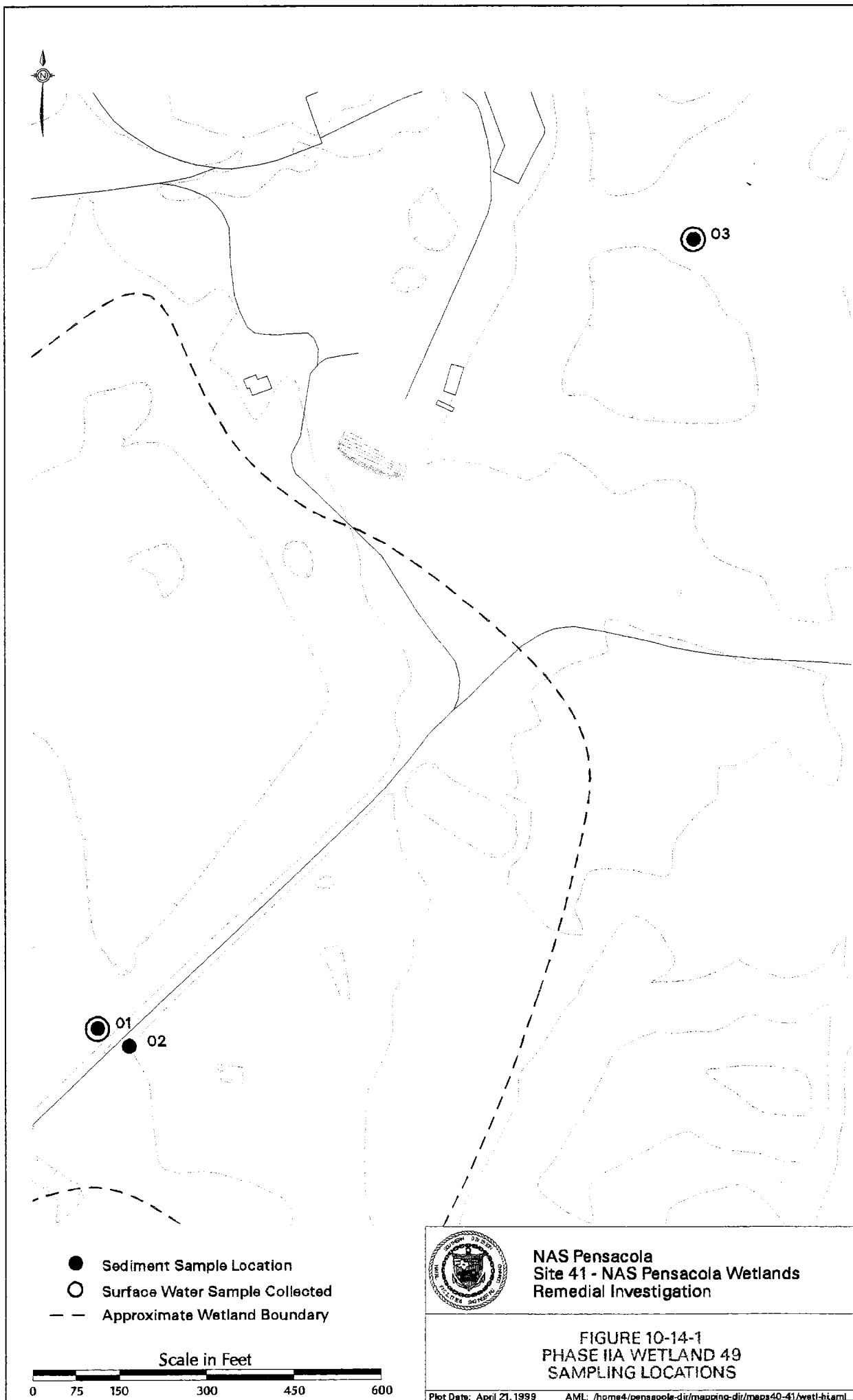
metabolites, and heptachlor epoxide. 4,4'-DDD exceeded its basewide level (50 ppb) at locations 4901 (94 ppb) and 4902 (59 ppb). Four SVOCs were detected in Wetland 49 sediment samples, including one PAH and three phthalate esters. Bis(2-ethylhexyl)phthalate exceeded its sediment benchmark level (182 ppb) at location 4901 (1,700 ppb). The VOC chloromethane was detected in sample 4903.

Table 10-14-1 shows the Wetland 49 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-14-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-14-2. The HQs will be further discussed ecological risk section (Section 10.14.4).

### **Surface Water**

Nine metals were detected in Wetland 49 surface water samples. Aluminum (1,800 ppb), and lead (3.1 ppb) exceeded their surface water quality criteria (87 ppb and 3.1 ppb) at sample location 4903. The only organic constituent detected in Wetland 49 surface water samples was acetone, a common laboratory contaminant.

Table 10-14-3 shows the Wetland 49 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-14-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-14-4. The HQs will be further discussed in the ecological risk section (Section 10.14.4).



**Table 10-14-1**  
**Phase IIA Detected Concentrations in Wetland 49 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	1500 - 3560	2686.67
Arsenic (As)	1/3	0.21	0.21
Barium (Ba)	3/3	1.7 - 5.6	4.3
Calcium (Ca)	3/3	14.4 - 1630	676.47
Chromium (Cr)	3/3	0.99 - 2.6	2.03
Cobalt (Co)	3/3	0.15 - 0.2	0.17
Copper (Cu)	3/3	0.49 - 1.6	1.097
Iron (Fe)	3/3	407 - 707	554
Lead (Pb)	3/3	2.7 - 7.2	5.57
Magnesium (Mg)	3/3	43.3 - 123	81.8
Manganese (Mn)	3/3	0.94 - 7	3.38
Mercury (Hg)	1/3	0.06	0.06
Nickel (Ni)	1/3	0.91	0.91
Potassium (K)	3/3	26.2 - 66	50.63
Sodium (Na)	3/3	17.9 - 30.4	22.17
Vanadium (V)	3/3	2.1 - 3	2.63
Zinc (Zn)	3/3	0.96 - 7.6	5.02
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	2/3	59 - 94	76.5
4,4'-DDE	2/3	9.2 - 18	13.6
4,4'-DDT	2/3	1.2 - 3	2.1
Heptachlor epoxide	1/3	1.1	1.1
<b>SVOCs (μg/kg)</b>			
Butylbenzylphthalate	1/3	30	30
Di-n-butylphthalate	1/3	39	39
Pyrene	1/3	21	21
bis(2-Ethylhexyl)phthalate (BEHP)	1/3	1700	1700
<b>VOCs (μg/kg)</b>			
Chloromethane	1/3	2	2

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilograms (mg/kg) or parts per million (ppb).

**Table 10-14-2**  
**Wetland 49**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M490101</b>					
	4,4'-DDD (UG/KG)	94 D/L	1.22	77.05	b
	4,4'-DDE (UG/KG)	18	2.07	8.70	b
	4,4'-DDT (UG/KG)	1.2 J	1.18	1.01	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	1700	182	9.34	b
	Chromium (MG/KG)	2.5	52.3	0.05	a b
	Copper (MG/KG)	1.6 J	18.7	0.09	a b
	Lead (MG/KG)	7.2	30.2	0.24	a b
	Mercury (MG/KG)	0.06 J	0.13	0.46	a b
	Pyrene (UG/KG)	21 J	153	0.14	b
	Zinc (MG/KG)	7.0	124	0.06	a b
<b>041M490301</b>					
	Chromium (MG/KG)	0.99	52.3	0.02	a b
	Copper (MG/KG)	0.99 J	18.7	0.03	a b
	Lead (MG/KG)	2.7	30.2	0.09	a b
	Zinc (MG/KG)	0.96 J	124	0.01	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

**Table 10-14-3**  
**Phase IIA Detected Concentrations in Wetland 49 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/2	1800	1800
Calcium (Ca)	2/2	692 - 4500	2596
Iron (Fe)	2/2	73 - 821	447
Lead (Pb)	1/2	3.1	3.1
Magnesium (Mg)	2/2	733 - 1100	916.5
Manganese (Mn)	2/2	1.9 - 7.4	4.65
Potassium (K)	1/2	180	180
Sodium (Na)	2/2	6750 - 13100	9925
Vanadium (V)	2/2	2.3	2.3
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Acetone	2/2	4.6	5

*Note:*

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### 10.14.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-14-5 presents those contaminants present in sediment above sediment benchmark levels and their calculated SSLs. Contaminants present in surface water above appropriate standards were previously presented in Table 10-14-4.

### Transport into the Wetland

#### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 49 through this pathway:

Table 10-14-4 (1)

## Wetland 49

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W490301	Freshwater					
Aluminum		UG/L	1,600.0	87.0	20.68966	a
Iron		UG/L	821.0	1,000.0	0.821	a b
Lead		UG/L	3.1	1.71	1.81287	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-14-5  
 Calculated Sediment Screening Values for Wetland 49

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Organics (ppb)</b>					
4,4'-DDE	10.5 <sup>a</sup>	5.68E+04	5.96E+07	18	NO
4,4'-DDD	0.0064 <sup>a</sup>	1.27E+04	8.13E+03	94	NO
4,4'-DDT	0.001 <sup>a,b</sup>	3.34E+04	3,340	3	NO

**Notes:**

Kd for organics calculated using foc of 0.012 (numerical average of all sediment samples).  
 Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

Potential storm water runoff and sediment entrainment from the petroleum Site 19 (the jet fuel pipeline associated with IR Site 19) and from the western end of the Forrest Sherman airfield complex.

The presence of sediment contaminants above benchmark levels (see Table 10-14-5) validates the sediment transport pathway and by inference the surface water pathway. Additionally, two inorganics were present in surface water above standards, further validating the pathway.

### Groundwater Discharge Pathway

Based on potentiometric analysis, the primary potential source that would contribute contamination to Wetland 49 through this pathway is the petroleum Site 19. Groundwater at this site has been shown to be contaminated, and therefore the pathway is considered valid.



## **Transport within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of wetland, along with landform analysis, indicates that Wetland 49 is connected to Wetland 51, but the direction of flow is not evident. However, the Wetland 49/51 complex is self-enclosed and not in direct contact with an exterior stress. Surface water movement and sediment transport can therefore be considered to be stable and subject only to surface water influx during rain events.

### *Sediment Leaching to Surface Water Pathway*

Three organics, all pesticides, exceeded their benchmark levels, but did not exceed their calculated SSL. Only 4,4'-DDD exceeded its basewide level. Additionally, the two inorganic parameters above criteria in surface water were not above benchmark levels (which are lower values than SSLs) in sediment, suggesting the source for that contaminant is related to the surface water pathway or groundwater discharge source. The sediment leaching pathway is considered invalid for this wetland, and sediment contamination is not expected to partition to surface water.

## **Transport from the Wetland**

Surface water and sediment movement can be expected to be stable and remain within the wetland.

### **10.14.4 Ecological Risk Assessment**

HQs for Wetland 49 sediment samples are presented in Table 10-14-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed a HQ above 1 for 4,4'-DDD (77.05), 4,4'-DDE (8.70), 4,4'-DDT (1.01), and bis(2-ethylhexyl)phthalate (9.34) at sample location 4901. The HQ was also greater than 1 for 4,4'-DDD (48.36), 4,4'-DDE (4.44), and 4,4'-DDT (2.52) at sample location 4902. Phase IIA surface water HQs greater than 1 for aluminum (20.69), and lead (1.81) ranged from 0.073 at location 4901 to 23.32 at location 4903. HQs greater than 1 indicate a potential for excess risk.

Wetland 49 was classified in Group E. Because aquatic and terrestrial receptors were not expected to be exposed to wetlands in Group E, they were also eliminated from further sampling and analysis. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.14.5 Human Health Risk Assessment**

##### **10.14.5.1 Samples Included**

###### **Sediment**

041M490101, 041M490201, 041M490301

###### **Surface Water**

041W490101, 041W490201

##### **10.14.5.2 Current and Future Land Use**

Wetland 49 is in an area west of Forrest Sherman Field that is restricted to public access. This restriction is due to the area's proximity to the airfield, and because the base pistol range is on the northern side of the wetland. Warning flags and signs are posted to caution passersby when the pistol range is in use. Maintenance workers can be expected to occasionally visit the area.

##### **10.14.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

##### **10.14.5.4 Sediment COPCs**

As shown in Table 10-14-6, no sediment COPCs were identified.

##### **10.14.5.5 Surface Water COPCs**

As shown in Table 10-14-7, no surface water COPCs were identified.

TABLE 10-14-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 49 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Deletion or Selection
72548	4,4'-DDD	59.0000	DJ	94.0000	DJ	UG/KG	041M490101	2 / 3	0.24 - 0.24	76.50	94	N/A	92000	57000	C	N/A	NO BSL
72559	4,4'-DDE	9.2000		18.0000		UG/KG	041M490201	2 / 3	0.24 - 0.24	13.60	18	N/A	65000	41000	C	N/A	NO BSL
50293	4,4'-DDT	1.2000	J	3.0000	J	UG/KG	041M490201	2 / 3	0.24 - 0.24	2.10	3	N/A	65000	41000	C	N/A	NO BSL
7429905	Aluminum (Al)	1500.0000		3560.00		MG/KG	041M490201	3 / 3	NAV	2687	3560	N/A	320000	490000	N	N/A	NO BSL
7440382	Arsenic (As)	0.2100	J	0.2100	J	MG/KG	041M490201	1 / 3	0.14 - 0.14	0.21	0.21	N/A	15	9.2	C	N/A	NO BSL
7440393	Barium (Ba)	1.7000	J	5.60		MG/KG	041M490301	3 / 3	NAV	4.3	5.6	N/A	22000	34000	N	N/A	NO BSL
117817	bis(2-Ethylhexyl)phthalate (	1700.0000		1700.0000		UG/KG	041M490101	1 / 3	460.00 - 490.00	1700	1700	N/A	1600000	980000	C	N/A	NO BSL
85687	Butylbenzylphthalate	30.0000	J	30.0000	J	UG/KG	041M490101	1 / 3	460.00 - 490.00	30	30	N/A	63000000	98000000	N	N/A	NO BSL
7440702	Calcium (Ca)	14.4000		1630.00		MG/KG	041M490101	3 / 3	NAV	676	1630	N/A	N/A	N/A	N/A	NO	EN
74873	Chloromethane	2.0000	J	2.0000	J	UG/KG	041M490301	1 / 3	13.00 - 65.00	2	2	N/A	1700000	1100000	C	N/A	NO BSL
7440473	Chromium (Cr)	0.9900		2.60		MG/KG	041M490101	3 / 3	NAV	2.03	2.6	N/A	1600	2500	N	N/A	NO BSL
7440484	Cobalt (Co)	0.1500	J	0.20	J	MG/KG	041M490101	3 / 3	NAV	0.17	0.2	N/A	19000	29000	N	N/A	NO BSL
7440508	Copper (Cu)	0.4900	J	1.60	J	MG/KG	041M490101	3 / 3	NAV	1.1	1.6	N/A	13000	20000	N	N/A	NO BSL
84742	Di-n-butylphthalate	39.0000	J	39.0000	J	UG/KG	041M490101	1 / 3	460.00 - 490.00	39	39	N/A	32000000	49000000	N	N/A	NO BSL
1024573	Heptachlor epoxide	1.1000	J	1.1000	J	UG/KG	041M490201	1 / 3	0.12 - 1.00	1.1	1.1	N/A	2400	1500	C	N/A	NO BSL
7439896	Iron (Fe)	407.0000		707.00		MG/KG	041M490101	3 / 3	NAV	554	707	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	2.7000		7.20		MG/KG	041M490301	3 / 3	NAV	5.57	7.2	N/A	400	400		OSWER	NO BSL
7439954	Magnesium (Mg)	43.3000	J	123.00	J	MG/KG	041M490301	3 / 3	NAV	82	123	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	0.9400	J	7.00		MG/KG	041M490101	3 / 3	NAV	3.38	7	N/A	15000	23000	N	N/A	NO BSL
7439976	Mercury (Hg)	0.0600	J	0.0600	J	MG/KG	041M490101	1 / 3	0.06 - 0.06	0.06	0.06	N/A	95	2.3	N	N/A	NO BSL
7440020	Nickel (Ni)	0.9100	J	0.9100	J	MG/KG	041M490201	1 / 3	0.64 - 0.65	0.91	0.91	N/A	6300	9800	N	N/A	NO BSL
7440097	Potassium (K)	26.2000	J	66.00	J	MG/KG	041M490201	3 / 3	NAV	51	66	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	21.0000	J	21.0000	J	UG/KG	041M490101	1 / 3	46.00 - 49.00	21	21	N/A	9500000	15000000	N	N/A	NO BSL
7440235	Sodium (Na)	17.9000	J	30.40		MG/KG	041M490301	3 / 3	NAV	22	30.4	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	2.1000	J	3.00	J	MG/KG	041M490101	3 / 3	NAV	2.63	3	N/A	2200	3400	N	N/A	NO BSL
7440666	Zinc (Zn)	0.9600	J	7.60		MG/KG	041M490201	3 / 3	NAV	5.02	7.6	N/A	95000	15000	N	N/A	NO BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

TABLE 10-14-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 49 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
67641	Acetone	4.00	J	6.00	J	UG/L	041W490301	2 / 2	NAV	5.00	6	N/A	21000	35000	N	N/A	NO	BSL
7429905	Aluminum (Al)	1800.00	J	1800.00	J	UG/L	041W490301	1 / 2	NAV	1800.00	1800	N/A	120000	250000	N	N/A	NO	BSL
7440702	Calcium (Ca)	692.00	J	4500.00	J	UG/L	041W490101	2 / 2	NAV	2596.00	4500	N/A	N/A	N/A	N/A	NO	EN	
7439896	Iron (Fe)	73.00	J	821.00	J	UG/L	041W490301	2 / 2	NAV	447.00	821	N/A	N/A	N/A	N	N/A	NO	EN
7439921	Lead (Pb)	3.10	J	3.10	J	UG/L	041W490301	1 / 2	NAV	3.10	3.1	N/A	15	15	TTAL	NO	BSL	
7439954	Magnesium (Mg)	733.00	J	1100.00	J	UG/L	041W490301	2 / 2	NAV	916.50	1100	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	1.90	J	7.40	J	UG/L	041W490301	2 / 2	NAV	4.65	7.4	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	180.00	J	180.00	J	UG/L	041W490101	1 / 2	NAV	180.00	180	N/A	N/A	N/A	N/A	NO	EN	
7440235	Sodium (Na)	6750.00	J	13100.00	J	UG/L	041W490301	2 / 2	NAV	9925.00	13100	N/A	N/A	N/A	N/A	NO	EN	
7440622	Vanadium (V)	2.30	J	2.30	J	UG/L	041W490301	2 / 2	NAV	2.30	2.3	N/A	830	1800	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.14.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 49.

#### **10.14.6 Conclusions and Recommendations**

Wetland 49 is intermittent, and due to its location is not expected to be a significant source of food, water, or habitat. Therefore, as proposed in the approved RI/FS SAP Addendum (EnSafe, 1997), this wetland was eliminated from further risk characterization. Since no COPCs were identified for Wetland 49, no formal HHRA was conducted. Because no excess ecological or human health risks are present at Wetland 49, no further action was recommended and approved for this wetland.

## **10.15 WETLAND 13**

### **10.15.1 Site Description**

Wetland 13 is in the northeastern quadrant of NAS Pensacola, southeast of the bilge water plant of the NAS Pensacola waste water treatment plant. Parsons and Pruitt described this area as a palustrine forested site with emergent vegetation (USEPA, 1991). The dominant vegetation in this area includes pines, black willow (*Salix nigra*), and smartweed (*Polygonum sp.*), with sawgrass (*Cladium jamaicense*) in the small open water portion. Wetland 13 is seasonally saturated, and has only a small area of standing surface water during the wet season.

The IR site potentially affecting Wetland 13 is Site 13 (Magazine Point Rubble Disposal Site), which extends along the eastern shore of Magazine Point and the former Chevalier Field (now the NATTC). Rubble from Site 13 is distributed along the eastern side of Wetland 13. The proximity of the bilge water plant may also have been a concern for this wetland.

### **10.15.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-15-1 denotes the Phase IIA Wetland 13 sampling location.

#### **Sediment**

Seventeen metals were detected in the single Wetland 13 sediment sample. No metals exceeded a sediment benchmark level at Wetland 13. Pesticides detected in Wetland 13 sediment included 4,4'-DDE, 4,4'-DDT and dieldrin. 4,4'-DDE (1.9 ppb) and 4,4'-DDT (1.4 ppb) were below their basewide levels (40 ppb and 20 ppb). Basewide levels are described in Section 6. Dieldrin (0.3 ppb) was also below its benchmark level (0.72 ppb). No PCBs were detected in Wetland 13 sediment. Three SVOCs were detected in Wetland 13 sediment, including fluoranthene, di-n-butylphthalate, and bis(2-ethylhexyl)phthalate. SVOC detections were below sediment benchmark levels. No VOCs were detected in the Wetland 13 sediment sample.

Table 10-15-1 shows the Wetland 13 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-15-2, which presents only the parameters with sediment benchmark levels, compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.15.4).

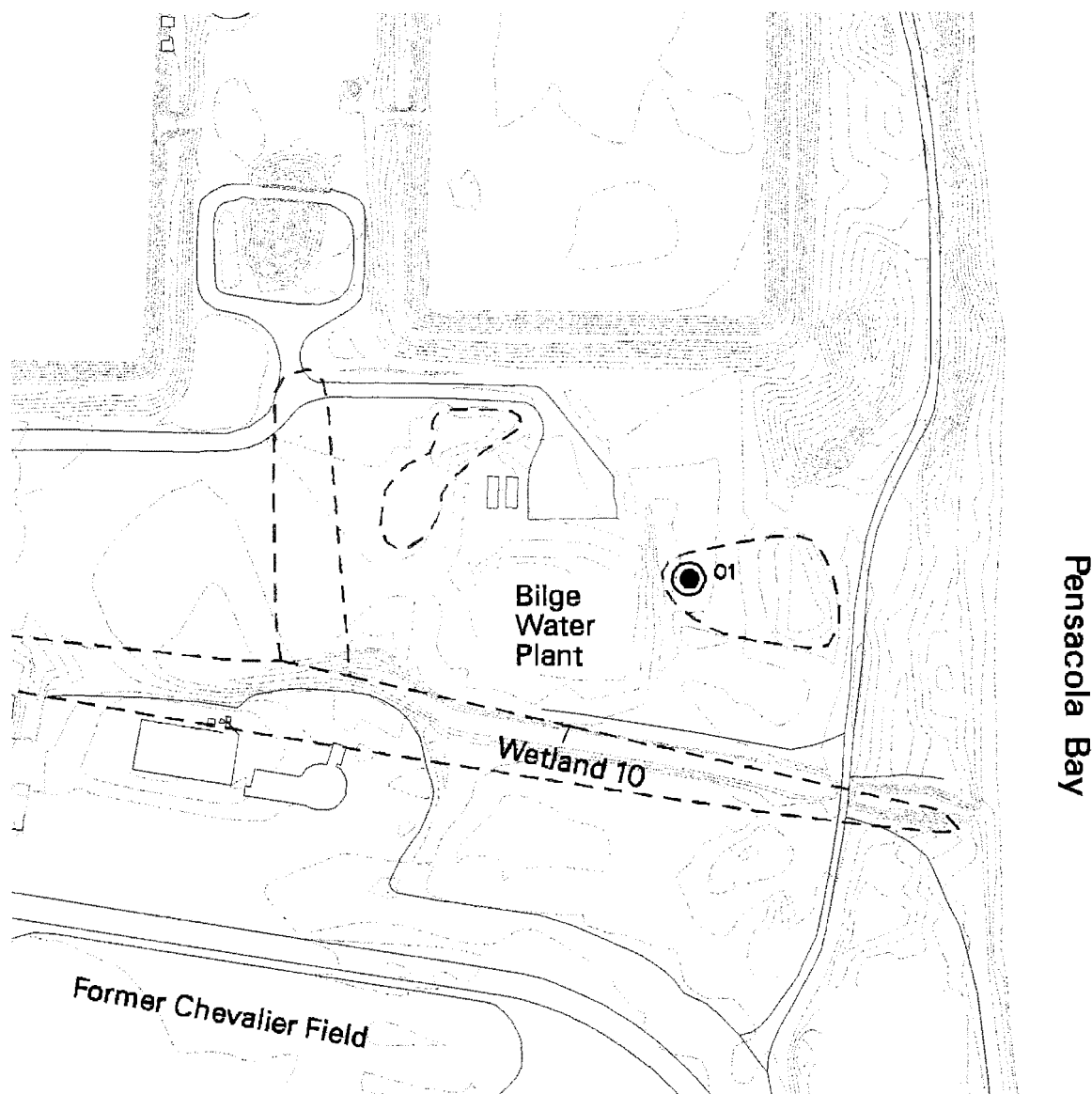
### **Surface Water**

Twenty-one metals were detected in the single Wetland 13 surface water sample. Aluminum (145,000 ppb), beryllium (4.4 ppb), cadmium (9.8 ppb), chromium (225 ppb), copper (142 ppb), iron (36,200 ppb), lead (1,220 ppb), mercury (1.3 ppb), selenium (13.6 ppb), and zinc (536 ppb) exceeded appropriate surface water quality criteria. However, the surface water sample was highly turbid (greater than 1,000 NTU). No organic constituents were detected in Wetland 13 surface water.

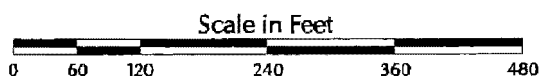
Table 10-15-3 shows the Wetland 13 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-15-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only parameters with water quality criteria are listed in Table 10-15-4. The HQs will be further discussed in the ecological risk section (Section 10.15.4).

### **10.15.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland.



- Sediment Sample Location
- Surface Water Sample Collected
- Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-15-1  
PHASE IIA WETLAND 13  
SAMPLING LOCATIONS**



Table 10-15-1  
 Phase IIA Detected Concentrations in Wetland 13 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	1/1	1590	1590
Antimony (Sb)	1/1	0.15	0.15
Arsenic (As)	1/1	0.14	0.14
Barium (Ba)	1/1	0.88	0.88
Beryllium (Be)	1/1	0.11	0.11
Calcium (Ca)	1/1	327	327
Chromium (Cr)	1/1	4	4
Copper (Cu)	1/1	1.2	1.2
Iron (Fe)	1/1	229	229
Lead (Pb)	1/1	9.2	9.2
Magnesium (Mg)	1/1	187	187
Manganese (Mn)	1/1	0.85	0.85
Potassium (K)	1/1	50.6	50.6
Selenium (Se)	1/1	0.41	0.41
Sodium (Na)	1/1	290	290
Vanadium (V)	1/1	7.5	7.5
Zinc (Zn)	1/1	1.7	1.7
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDE	1/1	1.9	1.9
4,4'-DDT	1/1	1.4	1.4
Dieldrin	1/1	0.3	0.3
<b>SVOCs (μg/kg)</b>			
Di-n-butylphthalate	1/1	26	26
Fluoranthene	1/1	29	29
bis(2-Ethylhexyl)phthalate (BEHP)	1/1	31	31

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion, except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-15-2  
Wetland 13  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M130101</b>					
	4,4'-DDE (UG/KG)	1.9 J	2.07	0.92	b
	4,4'-DDT (UG/KG)	1.4 J	1.19	1.18	b
	Antimony (MG/KG)	0.15 J	12	0.01	a
	Arsenic (MG/KG)	0.14 J	7.24	0.02	a b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	31 J	182	0.17	b
	Chromium (MG/KG)	4	52.3	0.08	a b
	Copper (MG/KG)	1.2 J	18.7	0.06	a b
	Dieldrin (UG/KG)	0.3 J	0.72	0.42	b
	Fluoranthene (UG/KG)	29 J	113	0.26	b
	Lead (MG/KG)	9.2 J	30.2	0.30	a b
	Zinc (MG/KG)	1.7	124	0.01	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

**Table 10-15-3**  
**Phase IIA Detected Concentrations in Wetland 13 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	145000	145000
Antimony (Sb)	1/1	2.8	2.8
Arsenic (As)	1/1	26.6	26.6
Barium (Ba)	1/1	95.4	95.4
Beryllium (Be)	1/1	4.4	4.4
Cadmium (Cd)	1/1	9.8	9.8
Calcium (Ca)	1/1	47500	47500
Chromium (Cr)	1/1	225	225
Cobalt (Co)	1/1	7.8	7.8
Copper (Cu)	1/1	142	142
Iron (Fe)	1/1	36200	36200
Lead (Pb)	1/1	1220	1220
Magnesium (Mg)	1/1	37100	37100
Manganese (Mn)	1/1	150	150
Mercury (Hg)	1/1	1.3	1.3
Nickel (Ni)	1/1	47.2	47.2
Potassium (K)	1/1	16600	16600
Selenium (Se)	1/1	13.6	13.6
Sodium (Na)	1/1	199000	199000
Vanadium (V)	1/1	324	324
Zinc (Zn)	1/1	536	536

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-15-4 (1)

## Wetland 13

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W130101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	145,000.0	87.0	1,666.66667	a
	Antimony	UG/L	2.8	160.0	0.0175	a
	Arsenic	UG/L	26.6	50.0	0.532	b
	Beryllium	UG/L	4.4	0.13	33.84616	b
	Cadmium	UG/L	9.8	0.774	12.6615	a b
	Chromium	UG/L	225.0	11.0	20.45455	a b
	Copper	UG/L	142.0	7.8	18.20513	a b
	Iron	UG/L	36,200.0	1,000.0	36.2	a b
	Lead	UG/L	1,220.0	1.71	713.45028	a b
	Mercury	UG/L	1.3	0.012	108.33333	a b
	Nickel	UG/L	47.2	104.0	0.45385	a b
	Selenium	UG/L	13.6	5.0	2.72	a b
	Zinc	UG/L	536.0	70.2	7.63533	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Sediment transport and storm water runoff data are lacking, thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-15-5 presents those contaminants present in sediment above sediment benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-15-4.

**Table 10-15-5**  
**Calculated Sediment Screening Values for Wetland 13**

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Organics (ppb)</b>					
4,4'-DDT	0.001 <sup>a, b</sup>	3.61E+04	3,610	1.4	NO

**Notes:**

Kd for organics calculated using foc of 0.0138 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## Transport into the Wetland

### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 13 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 13, 32, 33, and 35, and from the bilge water plant and northern portions of former Chevalier Field (now the NATTC).

The presence of a single sediment contaminant above sediment benchmark levels (see Table 10-15-5) validates the sediment transport pathway (albeit not greatly significant) and by inference the surface water pathway. Additionally, ten inorganics were present in surface water above water quality criteria, further validating the pathway. As previously stated, the surface water sample was highly turbid which may have contributed to the number of inorganic exceedances.

#### *Groundwater Discharge Pathway*

Based on potentiometric analysis, there are no known sources that would contribute contamination to Wetland 13 through this pathway. Therefore, the pathway is considered invalid.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway*

The configuration of wetland, along with landform analysis, indicates that wetland is self-enclosed and not in direct contact with an exterior stress. Surface water movement and sediment transport can therefore be considered to be stable and subject only to surface water influx during rain events.

#### *Sediment Leaching to Surface Water Pathway*

One pesticide exceeded its sediment benchmark level, but did not exceed its SSL nor its basewide level. Additionally, those parameters above water quality criteria in surface water were not above benchmark levels (which are lower values than SSLs) in sediment. The source for these contaminants may be related to the surface water pathway, undetermined groundwater discharge source, or high turbidity. The sediment leaching pathway is considered invalid for this wetland, and sediment contamination is not expected to partition to surface water.

### **Transport from the Wetland**

Surface water and sediment movement can be expected to be stable and remain within the wetland.

#### **10.15.4 Ecological Risk Assessment**

HQs for the single Wetland 13 sediment sample are presented in Table 10-15-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed a HQ above 1 for 4,4'-DDT (1.18). No other sediment detections had a HQ greater than 1. As noted in the nature and extent discussion, the concentrations of 4,4'-DDE and 4,4-DDT in the single Wetland 13 sediment sample were below the basewide levels. Phase IIA surface water results revealed HQs greater than 1 for aluminum (1,666.67), beryllium (33.85), cadmium (12.66), chromium (20.45), copper (18.21), iron (36.2), lead (713.45), mercury (108.33), selenium (2.72), and zinc (7.64). However, as noted in the nature and extent discussion, the HQ exceedances in the Wetland 13 surface water sample may be attributable to this sample's high turbidity. HQs greater than 1 indicate a potential for excess risk.

Wetland 13 is classified as a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.15.5 Human Health Risk Assessment**

##### **10.15.5.1 Samples Included**

###### **Sediment**

041M130101

###### **Surface Water**

041W130101

#### **10.15.5.2 Current and Future Land Use**

Wetland 13 lies in a wooded zone north of the NATTC at NAS Pensacola, at the southern end of Magazine Point. Wetland 13 is east of the bilge water plant of the waste water treatment plant. Wetland 12 is west. The Magazine Point area is posted as a restricted location that is patrolled by base police. Routine grounds maintenance activities are periodically performed near Wetland 13 to control weeds and brush. There is no recreational use of this area. Unlikely uses could include occasional trespassing or use by children who find the area attractive. More than 50% of the sediment at Wetland 13 is exposed for most of the year, so assuming sediment exposure would be similar to soil exposure. Dermal contact could be a significant exposure pathway and was included in this HHRA; however, game fish habitat is limited, so fishing would not be expected. The adolescent trespasser scenario was considered to be conservatively representative of potential receptor populations for Wetland 13.

#### **10.15.5.3 Fish COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.15.5.4 Sediment COPCs Identified**

As shown in Table 10-15-6, no sediment COPCs were identified.

#### **10.15.5.5 Surface Water COPCs Identified**

As shown in Table 10-15-7, the following chemical was identified as a COPC:

- Aluminum
- Arsenic
- Lead



TABLE 10-15-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 13 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
72559	4,4'-DDE	1.9000	J	1.9000	J	UG/KG	041M130101	1 / 1	1.90	1.90	N/A	65000	1900	C	N/A	BSL
50293	4,4'-DDT	1.4000	J	1.4000	J	UG/KG	041M130101	1 / 1	1.40	1.40	N/A	65000	1900	C	N/A	BSL
7429905	Aluminum (Al)	1590.0000		1590.0000		MG/KG	041M130101	1 / 1	1590.00	1590.00	N/A	320000	7800	N	N/A	BSL
7440360	Antimony (Sb)	0.1500	J	0.1500	J	MG/KG	041M130101	1 / 1	0.15	0.15	N/A	130	3.1	N	N/A	BSL
7440382	Arsenic (As)	0.1400	J	0.1400	J	MG/KG	041M130101	1 / 1	0.14	0.14	N/A	15	0.43	C	N/A	BSL
7440393	Barium (Ba)	0.8800	J	0.8800	J	MG/KG	041M130101	1 / 1	0.88	0.88	N/A	22111	550	N	N/A	BSL
7440417	Beryllium (Be)	0.1100	J	0.1100	J	MG/KG	041M130101	1 / 1	0.11	0.11	N/A	632	16	N	N/A	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	31.0000	J	31.0000	J	UG/KG	041M130101	1 / 1	31.00	31.00	N/A	1579330	46000	C	N/A	BSL
7440702	Calcium (Ca)	327.0000	J	327.0000	J	MG/KG	041M130101	1 / 1	327.00	327.00	N/A	N/A	N/A	N/A	N/A	EN
7440473	Chromium (Cr)	4.0000		4.0000		MG/KG	041M130101	1 / 1	4.00	4.00	N/A	1600	23	N	N/A	BSL
7440508	Copper (Cu)	1.2000	J	1.2000	J	MG/KG	041M130101	1 / 1	1.20	1.20	N/A	13000	310	N	N/A	BSL
60571	Dieldrin	0.3000	J	0.3000	J	UG/KG	041M130101	1 / 1	0.30	0.30	N/A	1400	40	C	N/A	BSL
84742	Di-n-butylphthalate	26.0000	J	26.0000	J	UG/KG	041M130101	1 / 1	26.00	26.00	N/A	32000000	780000	N	N/A	BSL
206440	Fluoranthene	29.0000	J	29.0000	J	UG/KG	041M130101	1 / 1	29.00	29.00	N/A	13000000	310000	N	N/A	BSL
7439896	Iron (Fe)	229.0000		229.0000		MG/KG	041M130101	1 / 1	229.00	229.00	N/A	N/A	N/A	N/A	N/A	EN
7439921	Lead (Pb)	9.2000	J	9.2000	J	MG/KG	041M130101	1 / 1	9.20	9.20	N/A	400	400	N	OSWER	BSL
7439954	Magnesium (Mg)	187.0000	J	187.0000	J	MG/KG	041M130101	1 / 1	187.00	187.00	N/A	N/A	N/A	N/A	N/A	EN
7439965	Manganese (Mn)	0.8500	J	0.8500	J	MG/KG	041M130101	1 / 1	0.85	0.85	N/A	15000	1100	N	N/A	BSL
7440097	Potassium (K)	50.6000	J	50.6000	J	MG/KG	041M130101	1 / 1	50.60	50.60	N/A	N/A	N/A	N/A	N/A	EN
7782492	Selenium (Se)	0.4100	J	0.4100	J	MG/KG	041M130101	1 / 1	0.41	0.41	N/A	1600	39	N	N/A	BSL
7440235	Sodium (Na)	290.0000	J	290.0000	J	MG/KG	041M130101	1 / 1	290.00	290.00	N/A	N/A	N/A	N/A	N/A	EN
7440622	Vanadium (V)	7.5000		7.5000		MG/KG	041M130101	1 / 1	7.50	7.50	N/A	2200	55	N	N/A	BSL
7440686	Zinc (Zn)	1.7000		1.7000		MG/KG	041M130101	1 / 1	1.70	1.70	N/A	95000	2300	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background concentrations were not calculated for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables (USEPA, 1998).

(6) Rationale Codes

Selection Reason:

Deletion Reason:

Above Screening Levels (ASL)

Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

TABLE 10-15-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 13 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection
7429905	Aluminum (Al)	145000.000		145000.0000		UG/L	041W130101	1 / 1	NAV	145000.00	145000	N/A	120000	3700 N	N/A	YES	ASL
7440380	Antimony (Sb)	2.800	J	2.8000	J	UG/L	041W130101	1 / 1	NAV	2.00	2.8	N/A	48	1.5 N	N/A	NO	BSL
7440382	Arsenic (As)	26.600		26.6000		UG/L	041W130101	1 / 1	NAV	26.60	26.6	N/A	5.6	0.045 C	N/A	YES	ASL
7440393	Barium (Ba)	95.400	J	95.4000	J	UG/L	041W130101	1 / 1	NAV	95.40	95.4	N/A	8300	260 N	N/A	NO	BSL
7440417	Beryllium (Be)	4.400	J	4.4000	J	UG/L	041W130101	1 / 1	NAV	4.40	4.4	N/A	240	7.3 C	N/A	NO	BSL
7440439	Cadmium (Cd)	9.800		9.8000		UG/L	041W130101	1 / 1	NAV	9.80	9.8	N/A	60	1.8 N	N/A	NO	BSL
7440702	Calcium (Ca)	47500.000		47500.0000		UG/L	041W130101	1 / 1	NAV	47500.00	47500	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	225.000		225.0000		UG/L	041W130101	1 / 1	NAV	225.00	225	N/A	360	11 N	N/A	NO	BSL
7440484	Cobalt (Co)	7.800	J	7.8000	J	UG/L	041W130101	1 / 1	NAV	7.80	7.8	N/A	7100	220 N	N/A	NO	BSL
7440508	Copper (Cu)	142.000		142.0000		UG/L	041W130101	1 / 1	NAV	142.00	142	N/A	4800	150 N	N/A	NO	BSL
7439898	Iron (Fe)	36200.000		36200.0000		UG/L	041W130101	1 / 1	NAV	36200.00	36200	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	1220.000		1220.0000		UG/L	041W130101	1 / 1	NAV	1220.00	1220	N/A	15	15 N	TTAL	YES	ASL
7439954	Magnesium (Mg)	37100.000		37100.0000		UG/L	041W130101	1 / 1	NAV	37100.00	37100	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	150.000		150.0000		UG/L	041W130101	1 / 1	NAV	150.00	150	N/A	2400	73 N	N/A	NO	BSL
7439976	Mercury (Hg)	1.300		1.3000		UG/L	041W130101	1 / 1	NAV	1.30	1.3	N/A	36	1.1 N	N/A	NO	BSL
7440020	Nickel (Ni)	47.200		47.2000		UG/L	041W130101	1 / 1	NAV	47.20	47.2	N/A	2400	73 N	N/A	NO	BSL
7440097	Potassium (K)	16600.000		16600.0000		UG/L	041W130101	1 / 1	NAV	16600.00	16600	N/A	N/A	N/A	N/A	NO	EN
7782492	Selenium (Se)	13.600		13.6000		UG/L	041W130101	1 / 1	NAV	13.60	13.6	N/A	600	18 N	N/A	NO	BSL
7440235	Sodium (Na)	199000.000		199000.0000		UG/L	041W130101	1 / 1	NAV	199000.00	199000	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	324.000		324.0000		UG/L	041W130101	1 / 1	NAV	324.00	324	N/A	830	26 N	N/A	NO	BSL
7440686	Zinc (Zn)	536.000		536.0000		UG/L	041W130101	1 / 1	NAV	536.00	536	N/A	36000	1100 N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.15.5.6 Risk Characterization**

As shown in Table 10-15-8, arsenic is the only contributor to surface water risk estimates. The cumulative risk estimated for this wetland is  $2.4\text{E-}6$ . The HI shown in Table 10-15-9 was estimated to be 0.19. Arsenic was identified as a surface water COC water based on its contribution to the cumulative risk estimate for this wetland. Table 10-15-10 summarizes cancer risk estimates and noncancer hazard estimates for this wetland. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below.

#### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of the surface water concentration of lead at Wetland 13. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 13 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 13.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water during each visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 13 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of  $1220\text{ }\mu\text{g/L}$ , the annual alternate source exposure was estimated to be  $8.69\text{ }\mu\text{g}$  lead/day. Table 10-15-11 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

TABLE 10-15-8  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface water  
Exposure Medium: Surface water  
Exposure Point: Wetland 13  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.0266	MG/L	N/A	M	1.60E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	2.40E-06
Dermal	Arsenic	0.0266	MG/L	N/A	M	3.30E-10	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	2.48E-09
Total Risk										2.40E-06

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-15-9  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 13  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.0266	MG/L	N/A	M	1.10E-05	mg/kg-day	3.00E-04	mg/kg-day	0.037
	Aluminum	145	MG/L	N/A	M	5.97E-02	mg/kg-day	1.00E+00	mg/kg-day	0.060
Dermal	Arsenic	0.0266	MG/L		M	2.28E-06	mg/kg-day	6.00E-05	mg/kg-day	0.038
	Aluminum	145	MG/L		M	1.20E-02	mg/kg-day	2.00E-01	mg/kg-day	0.060
Total Hazard Index										0.194

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-15-10  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Site Trespasser  
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total
Surface Water	Surface Water	Wetland 13	Arsenic	2.40E-06	2.48E-09	2.40E-06	Arsenic Aluminum	skin	0.037	0.038	0.075
						gastrointestinal tract		0.060	0.060	0.120	
			(Total)	2.40E-06	2.48E-09	2.40E-06		(Total)	0.10	0.10	0.194
Total Risk Across All Wetlands						2.40E-06	Total Hazard Index Across All Wetlands				0.194

Table 10-15-11  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 13  
 Pensacola, Florida

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT  
 Indoor AIR Pb Conc: 30.0 percent of outdoor.  
 Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT  
 WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.  
 Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 13 surface water  
 6-7: 8.69  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model  
 Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil + Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7	3.4	10.35	4.81	3.30	1.11	4.09	0.09

Figure 10-15-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 3.4  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.97%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, the surface water lead concentration found at Wetland 13 would not require specific action under the hypothetical exposure scenario.

#### **10.15.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was the only COC identified at this wetland. Because arsenic was identified as a COC for surface water based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed.

An exposure point concentration of 0.0266 mg/L for arsenic resulted in a cancer risk estimate of 2.4E-6 for the adolescent trespasser, as shown in Table 10-15-8 for surface water. Using a linear ratio, 0.011 mg/L would correspond with a cancer hazard of 1E-6. Therefore, 0.11 mg/L and 1.1 mg/L represent cancer hazards of 1E-5 and 1E-4, respectively.

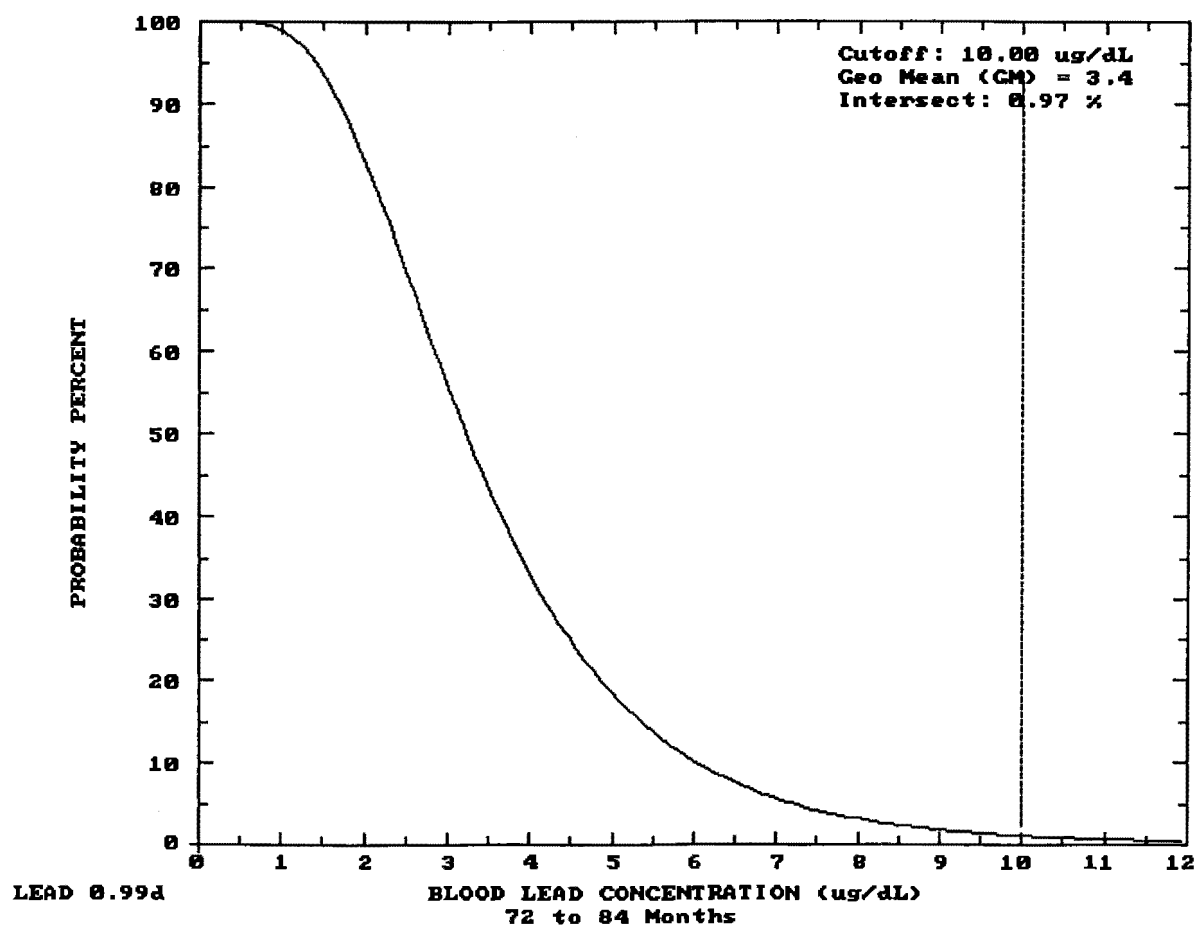
#### **10.15.6 Conclusions and Recommendations**

Wetland 13 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III.

The HHRA identified no sediment or fish tissue COPCs at Wetland 13. Aluminum, arsenic, and lead were identified as surface water COPCs. Arsenic was considered the only contributor to risk



Figure 10-15-2 Probability Percentage of Blood Lead Levels



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for the surface water pathway at Wetland 13. Under USEPA guidelines, surface water lead concentrations at Wetland 13 would not require specific action under the hypothetical exposure scenario. Under an adolescent trespasser scenario, the surface water EPC of 0.0266 mg/L for arsenic resulted in a risk estimate of 2.4E-6. Linear ratio analyses reveals that a target risk of 1E-6 results from an EPC of 0.011 mg/L, with EPCs of 0.11 mg/L and 1.1 mg/L representing target risks of 1E-5 and 1E-4, respectively.

Because of the limited overall ecological risk at Wetland 13, the restricted access to the area, and the limited potential for surface water ingestion by adolescent trespassers, no further action is recommended for Wetland 13.

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## **10.16 WETLAND 17**

### **10.16.1 Site Description**

Wetland 17 is in the northern portion of the base, near Site 1, on the eastern shore of Redoubt Bayou. Parsons and Pruitt described this area as an estuarine system with emergent vegetation (USEPA, 1991). This wetland is roughly one-half acre in size and is dominated with black needlebush (*Juncus roemerianus*). It is tidally influenced and contains standing water during high and low tides. There is no stream or surface drainage feature contributing runoff to Wetland 17.

The IR site potentially affecting Wetland 17 is Site 1 (Sanitary Landfill), which was used from the mid-1950s until 1976 as the predominant disposal site for all solid wastes generated on the base.

### **10.16.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-16-1 denotes Phase IIA Wetland 17 sampling locations.

#### **Sediment**

Sixteen metals were detected in the Wetland 17 sediment samples. No metals exceeded a sediment benchmark level at Wetland 17. Pesticides detected in Wetland 17 sediment included 4,4'-DDD, 4,4'-DDE and gamma-BHC. The 4,4'-DDT and its metabolite were below basewide levels, which are described in Section 6. Gamma-BHC exceeded its sediment benchmark level (0.32 ppb) at sample location 1703 (0.51 ppb). The PCB, Aroclor-1260 was detected at all three sample locations below its benchmark level (21.6 ppb). One SVOC, bis(2-ethylhexyl)phthalate, was detected above its benchmark level (182 ppb) at sample location 1702 (2,300 ppb). Chlorobenzene was the only VOC detected in Wetland 17 sediment samples.

Table 10-16-1 shows the Wetland 17 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-16-2, which lists only the parameters with benchmark levels, compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.16.4).

### **Surface Water**

Ten metals were detected in the single Wetland 17 surface water sample, and thallium (16.3 ppb) was the only metal to exceed its surface water quality criteria (6.3 ppb). Methylene chloride, a common laboratory contaminant, was detected below its surface water quality criteria.

Table 10-16-3 shows the Wetland 17 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-16-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with water quality criteria are presented in Table 10-16-4. The HQs will be further discussed in the ecological risk section (Section 10.6.4).

### **10.16.3 Fate and Transport**

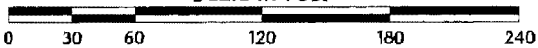
The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and stormwater runoff data are lacking, thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-16-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-16-4.



Redoubt Bayou

- Sediment Sample Location
- Surface Water Sample Collected
- - - Approximate Wetland Boundary

Scale in Feet



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-16-1  
PHASE IIA WETLAND 17  
SAMPLING LOCATIONS**

Table 10-16-1  
 Phase IIA Detected Concentrations in Wetland 17 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	438 - 842	598.67
Arsenic (As)	3/3	0.27 - 0.58	0.40
Barium (Ba)	3/3	0.48 - 0.73	0.57
Calcium (Ca)	3/3	57.5 - 129	87.57
Chromium (Cr)	3/3	2.1 - 3.6	2.9
Cobalt (Co)	2/3	0.14 - 0.17	0.16
Copper (Cu)	3/3	0.75 - 1.3	0.97
Iron (Fe)	3/3	467 - 1190	794.67
Lead (Pb)	3/3	2.2 - 3.4	2.6
Magnesium (Mg)	3/3	114 - 320	198
Manganese (Mn)	3/3	0.8 - 2.4	1.63
Potassium (K)	3/3	39.1 - 119	72.67
Sodium (Na)	3/3	2.75 - 1350	712.67
Thallium (Tl)	1/3	0.31	0.31
Vanadium (V)	3/3	1.4 - 2.1	1.7
Zinc (Zn)	3/3	1.8 - 4.2	2.8
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	1/3	0.23	0.23
4,4'-DDE	1/3	0.3	0.3
Aroclor-1260	3/3	0.7 - 2.8	1.46
Gamma-BHC (Lindane)	2/3	0.2 - 0.51	0.36
<b>SVOCs (μg/kg)</b>			
bis(2-Ethylhexyl)phthalate (BEHP)	1/3	2300	2300
<b>VOCs (μg/kg)</b>			
Chlorobenzene	1/3	2	2

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).



**Table 10-16-2**  
**Welland 17**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M170101</b>					
	4,4'-DDD (UG/KG)	0.23 J	1.22	0.19	b
	4,4'-DDE (UG/KG)	0.3	2.07	0.14	b
	Aroclor-1260 (UG/KG)	2.8	21.6	0.13	b
	Arsenic (MG/KG)	0.58 J	7.24	0.08	a,b
	Chromium (MG/KG)	2.1	52.3	0.04	a,b
	Copper (MG/KG)	0.87 J	18.7	0.05	a,b
	Lead (MG/KG)	2.3	30.2	0.07	a,b
	Zinc (MG/KG)	2.4	124	0.02	a,b

**041M170301**

4,4'-DDD (UG/KG)	0.23 J	1.22	0.19	b
4,4'-DDE (UG/KG)	0.3	2.07	0.14	b
Aroclor-1260 (UG/KG)	2.8	21.6	0.13	b
Arsenic (MG/KG)	0.58 J	7.24	0.08	a,b
Chromium (MG/KG)	2.1	52.3	0.04	a,b
Copper (MG/KG)	0.87 J	18.7	0.05	a,b
Lead (MG/KG)	2.3	30.2	0.07	a,b
Zinc (MG/KG)	2.4	124	0.02	a,b

**041M170301**

Aroclor-1260 (UG/KG)	0.7 J	21.6	0.03	b
Arsenic (MG/KG)	0.27 J	7.24	0.04	a,b
Chromium (MG/KG)	3.6	52.3	0.07	a,b
Copper (MG/KG)	1.1 J	18.7	0.07	a,b
gamma-BHC (Lindane) (UG/KG)	0.51	0.32	1.59	b
Lead (MG/KG)	3.4	30.2	0.11	a,b
Zinc (MG/KG)	4.2	124	0.03	a,b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.
- Basewide levels (detailed in Section 6) for DDT and its metabolites
- Basewide level for 4,4'-DDE is 40 ppb.
- Basewide level for 4,4'-DDD is 50 ppb.
- Basewide level for 4,4'-DDT is 20 ppb.

**Table 10-16-3**  
**Phase IIA Detected Concentrations in Wetland 17 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Arsenic (As)	1/1	2.2	2.2
Barium (Ba)	1/1	10.6	10.6
Calcium (Ca)	1/1	106000	106000
Iron (Fe)	1/1	263	263
Magnesium (Mg)	1/1	356000	356000
Manganese (Mn)	1/1	7.4	7.4
Potassium (K)	1/1	109000	109000
Sodium (Na)	1/1	3040000	3040000
Thallium (Tl)	1/1	16.3	16.3
Zinc (Zn)	1/1	4.7	4.7
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Methylene chloride	1/1	38	38

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

## Transport into the Wetland

### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 17 through this pathway:

- Potential storm water runoff and sediment entrainment from the Site 1. Additionally, there is a direct surface water connection with Bayou Grande, and backflushing of surface water will occur during periods of high tides and storm surge.

Table 10-16-4 (1)

## Wetland 17

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W170101</b>	<b>Saltwater</b>					
	Arsenic	UG/L	2.2	36.0	0.06111	a
	Iron	UG/L	263.0	300.0	0.87667	b
	Thallium	UG/L	16.3	6.3	2.5873	b
	Zinc	UG/L	4.7	86.0	0.05465	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-16-5  
 Calculated Sediment Screening Values for Wetland 17

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)		(ppb)	(ppb)	
Gamma BHC	0.16 <sup>a, b</sup>	0.299	6.92	0.51	NO
Bis(2-ethylhexyl)phthalate	NA	4.22E+03	NA	2,300	NA

**Notes:**

Kd for organics calculated using foc of 0.0028 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class II Water Quality Criteria (1996).

The presence of sediment contaminants above sediment benchmark levels (see Table 10-16-5) validates the sediment transport pathway, and by inference the surface water pathway. Thallium was the only parameter to exceed its water quality criteria in surface water.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 17 through this pathway:

- Discharge from Site 1. Groundwater at this site has been shown to be contaminated, thus the pathway is considered valid.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Bayou Grande. However, tidal fluctuations can create a temporary

landward movement. Therefore, both sediment and surface water contaminants can be expected to remain mobile.

#### *Sediment Leaching to Surface Water Pathway*

One pesticide and one semivolatile exceeded their sediment benchmark levels, but neither exceeded their SSL and corresponding detections of these constituents in surface water were not noted. Given the lack of parameters above SSLs and surface water quality criteria, this pathway is considered invalid.

#### **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Bayou Grande, and sediment contamination will remain mobile.

#### **10.16.4 Ecological Risk Assessment**

HQs for Wetland 17 sediment samples are presented in Table 10-16-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for the pesticide gamma-BHC (1.59) at sample location 1703, and the SVOC bis(2-ethylhexyl)phthalate (12.64) at sample location 1702. Phase IIA results of the single wetland 17 surface water sample revealed a HQ greater than 1 for thallium (2.59). HQs greater than 1 indicate the potential for excess risk.

Wetland 17 is classified as a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below screening or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

## **10.16.5 Human Health Risk Assessment**

### **10.16.5.1 Samples Included**

#### **Sediment**

041M170101, 041M170201, 041M170301

#### **Surface Water**

041W170101

### **10.16.5.2 Current and Future Land Use**

Wetland 17 is a small estuarine wetland on the south shoreline of Bayou Grande. The wetland is incorporated into the nature trail that traverses the northern part of the Site 1 area. A wooden bridge leads to a covered gazebo that sits on the northern side of Wetland 17. Accordingly, since Wetland 17 has been set aside for recreational use by NAS Pensacola personnel, all trespasser scenarios are valid.

### **10.16.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

### **10.16.5.4 Sediment COPCs**

As shown in Table 10-16-6, no sediment COPCs were identified.

### **10.16.5.5 Surface Water COPCs**

As shown in Table 10-16-7, the following surface water COPC was identified.

- Thallium

TABLE 10-16-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 17 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limit	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	0.2300	J	0.2300	J	UG/KG	041M170101	1 / 3	0.19 - 0.21	0.23	0.23	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	0.3000		0.3000		UG/KG	041M170101	1 / 3	0.19 - 0.21	0.30	0.3	N/A	65000	1900	C	N/A	NO	BSL
7429905	Aluminum (Al)	438.0000		842.00		MG/KG	041M170201	3 / 3	NAV	598.67	842	N/A	320000	7800	N	N/A	NO	BSL
11095825	Aroclor-1260	0.7000	J	2.80		UG/KG	041M170201	3 / 3	NAV	1.46	2.8	N/A	11000	320	C	N/A	NO	BSL
7440382	Arsenic (As)	0.2700	J	0.58	J	MG/KG	041M170201	3 / 3	NAV	0.40	0.58	N/A	15	0.43	C	N/A	NO	BSL
7440393	Barium (Ba)	0.4800	J	0.73	J	MG/KG	041M170201	3 / 3	NAV	0.57	0.73	N/A	22000	550	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (	2300.0000		2300.0000		UG/KG	041M170201	1 / 3	370.00 - 450.00	2300.00	2300	N/A	1600000	46000	C	N/A	NO	BSL
7440702	Calcium (Ca)	57.5000	J	129.00		MG/KG	041M170101	3 / 3	NAV	87.57	129	N/A	N/A	N/A	N/A	NO	EN	
108907	Chlorobenzene	2.0000	J	2.0000	J	UG/KG	041M170101	1 / 3	12.00 - 13.00	2.00	2	N/A	6300000	160000	N	N/A	NO	BSL
7440473	Chromium (Cr)	2.1000		3.60		MG/KG	041M170101	3 / 3	NAV	2.90	3.6	N/A	1600	23	N	N/A	NO	BSL
7440484	Cobalt (Co)	0.1400	J	0.1700	J	MG/KG	041M170201	2 / 3	0.13 - 0.13	0.16	0.17	N/A	19000	470	N	N/A	NO	BSL
7440508	Copper (Cu)	0.7500	J	1.30	J	MG/KG	041M170301	3 / 3	NAV	0.97	1.3	N/A	13000	310	N	N/A	NO	BSL
58899	gamma-BHC (Lindane)	0.2000	J	0.5100		UG/KG	041M170301	2 / 3	0.11 - 0.11	0.36	0.51	N/A	17000	490	C	N/A	NO	BSL
7439896	Iron (Fe)	467.0000		1190.00		MG/KG	041M170301	3 / 3	NAV	794.67	1190	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	2.2000		3.40		MG/KG	041M170201	3 / 3	NAV	2.60	3.4	N/A	400	400		N/A	NO	BSL
7439954	Magnesium (Mg)	114.0000	J	320.00	J	MG/KG	041M170201	3 / 3	NAV	198.00	320	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	0.8000	J	2.40		MG/KG	041M170101	3 / 3	NAV	1.63	2.4	N/A	15000	1100	N	N/A	NO	BSL
7440097	Potassium (K)	39.1000	J	119.00	J	MG/KG	041M170101	3 / 3	NAV	72.27	119	N/A	N/A	N/A	N/A	NO	EN	
7440235	Sodium (Na)	275.0000	J	1350.00		MG/KG	041M170101	3 / 3	NAV	712.67	1350	N/A	N/A	N/A	N/A	NO	EN	
7440280	Thallium (Tl)	0.3100	J	0.3100	J	MG/KG	041M170101	1 / 3	0.25 - 0.25	0.31	0.31	N/A	22	0.55	N	N/A	NO	BSL
7440622	Vanadium (V)	1.4000	J	2.10	J	MG/KG	041M170201	3 / 3	NAV	1.70	2.1	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	1.8000		4.20		MG/KG	041M170101	3 / 3	NAV	2.80	4.2	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(6) Rationale Codes Selection Reason:  
Deletion Reason:  
Above Screening Levels (BSL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-16-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 17 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection
7440382	Arsenic (As)	2.200	J	2.2000	J	UG/L	041W170101	1 / 1	NAV	2.2	2.2	N/A	5.6	0 045 C	N/A	NO	BSL
7440393	Barium (Ba)	10.600	J	10.6000	J	UG/L	041W170101	1 / 1	NAV	10.6	10.6	N/A	8300	25000 N	N/A	NO	BSL
7440702	Calcium (Ca)	106000.000	0	106000.0000	0	UG/L	041W170101	1 / 1	NAV	106000	106000	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	263.000	0	263.0000	0	UG/L	041W170101	1 / 1	NAV	263	263	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	356000.000	0	356000.0000	0	UG/L	041W170101	1 / 1	NAV	356000	356000	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	7.400	J	7.4000	J	UG/L	041W170101	1 / 1	NAV	7.4	7.4	N/A	2400	73 N	N/A	NO	BSL
75092	Methylene chloride	38.000	D	38.0000	D	UG/L	041W170101	1 / 1	NAV	38	38	N/A	1000	4.1 C	N/A	NO	BSL
7440097	Potassium (K)	109000.000	0	109000.0000	0	UG/L	041W170101	1 / 1	NAV	109000	109000	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	3040000.000	0	3040000.0000	0	UG/L	041W170101	1 / 1	NAV	3040000	3040000	N/A	N/A	N/A	N/A	NO	EN
7440280	Thallium (Tl)	16.300	0	16.3000	0	UG/L	041W170101	1 / 1	NAV	16.3	16.3	N/A	8.3	18 N	N/A	YES	ASL
7440668	Zinc (Zn)	4.700	J	4.7000	J	UG/L	041W170101	1 / 1	NAV	4.7	4.7	N/A	38000	1100 N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic



#### **10.16.5.6 Risk Characterization**

As shown in Table 10-16-8, thallium is the only contributor to hazard index estimates for the surface water pathway under the adolescent trespasser scenario. The hazard index was estimated to be 0.2. As discussed in Section 8 a COC was considered to be a constituent that contributed to a pathway of concern that exceeded unity (one), as a result, thallium was not considered a COC.

#### **10.16.5.7 Remedial Goal Options**

No COCs were identified for Wetland 17, and as a result, no RGOs were calculated.

#### **10.16.6 Conclusions and Recommendations**

Wetland 17 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III.

The HHRA found no fish tissue or sediment COPCs at Wetland 17. Thallium was considered a surface water COPC; however the hazard index was estimated to be 0.20, and thallium was therefore not considered a COC. No RGOs were therefore calculated for this wetland.

Wetland 17 is incorporated into the nature trail that traverses the northern part of the Site 1 area. Since the wetland has been set aside for recreational use by NAS Pensacola personnel, all trespasser scenarios are valid. However, the HHRA found the human health risk to be negligible at this wetland. Because of the limited overall ecological risk at Wetland 17, and the negligible human health risk at this wetland, no further action is recommended for Wetland 17.

TABLE 10-16-8  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 17  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Thallium	0.0163	MG/L	N/A	M	6.71E-06	mg/kg-day	7.00E-05	mg/kg-day	0.096
Dermal	Thallium	0.0163	MG/L		M	1.40E-06	mg/kg-day	1.40E-05	mg/kg-day	0.100
Total Hazard Index										0.20

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

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## **10.17 WETLAND 19**

### **10.17.1 Site Description**

Wetland 19 is at the southwest end of Redoubt Bayou, which drains to the north into Bayou Grande. Parsons and Pruitt divided this wetland into two parts, Wetlands 19A and 19B (USEPA, 1991). Wetland 19A is described as a palustrine emergent system and Wetland 19B as an estuarine emergent system. The area which makes up Wetlands 19A and 19B is approximately 2.2 acres in size. Wetland 19 is a confluence of the surface water drainage from Wetland 20. This system drains surface water from the northeast side Forrest Sherman Field and flows eastward through Wetland 19 into the southwest end of Redoubt Bayou. Surface water from Wetland 19A flows over a weir before discharging into Wetland 19B (an estuarine marsh), and then into Redoubt Bayou. A grassy right-of-way area running along portions of Wetland 19 is periodically mowed.

The IR site potentially affecting Wetland 19 is Site 16 (Brush Disposal Site), which has been used to dispose of brush and tree trimmings since late 1960s.

### **10.17.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-17-1 denotes the Phase IIA Wetland 19 sampling locations.

#### **Sediment**

Seventeen metals were detected in the Wetland 19 sediment samples. Arsenic exceeded the sediment benchmark level (7.24 ppm) at sample location 19A1 (15.7 ppm). Nine pesticides were detected in Wetland 19 sediment samples, including DDT and its metabolites, delta-BHC, dieldrin, endosulfan I, endrin, heptachlor epoxide, and gamma-Chlordane. The PCB Aroclor-1260 was also detected in Wetland 19 sediment samples. No pesticide or PCB concentration exceeded any appropriate level. Two SVOCs, fluoranthene and pyrene, were detected in Wetland 19

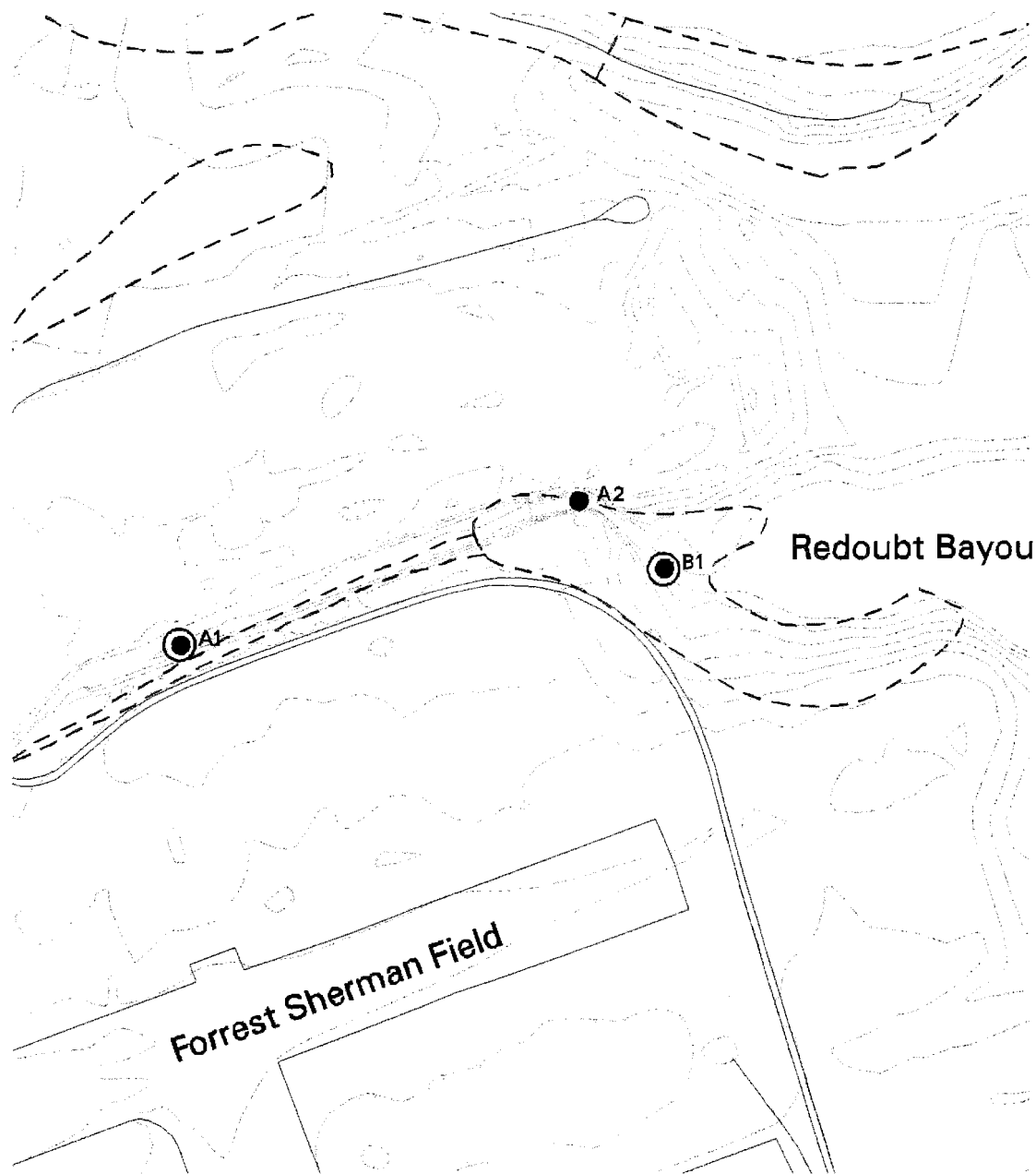
sediment samples below their benchmark levels. Chloromethane was the only VOC detected in Wetland 19 sediment samples.

Table 10-17-1 shows the Wetland 19 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-17-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-17-2. The HQs will be further discussed in the ecological risk section (Section 10.17.4).

### **Surface Water**

Nineteen metals were detected in the Wetland 19 surface water samples. The metals aluminum (111,000 ppb), arsenic (268 ppb), beryllium (4 ppb), chromium (99.5 ppb), copper (41.9 ppb), iron (332,000 ppb), lead (86.9 ppb), mercury (0.59 ppb), and zinc (204 ppb) exceeded surface water quality criteria sample location 1901. Aluminum (2,140 ppb), iron (4,030 ppb), and lead (5.6 ppb) also exceeded criteria at sample location 1903. The only organic detection at Wetland 19 was di-n-butylphthalate (28 ppb), which exceeded its surface water criteria (3 ppb) at sample location 1901. Surface water samples collected were slightly turbid with readings of 41NTUs in Wetland 19A and 19NTUs in Wetland 19B.

Table 10-17-3 shows the Wetland 19 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-17-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.17.4).



- Sediment Sample Location
- Surface Water Sample Collected
- Approximate Wetland Boundary

Scale in Feet

0 120 240 480 720 960



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-17-1  
PHASE IIA WETLAND 19  
SAMPLING LOCATIONS**

Table 10-17-1  
 Phase IIA Detected Concentrations in Wetland 19 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	494 - 18900	6790
Arsenic (As)	3/3	0.17 - 15.7	5.57
Barium (Ba)	3/3	0.58 - 30.2	10.51
Beryllium (Be)	1/3	0.48	0.48
Calcium (Ca)	3/3	47.5 - 1720	639.5
Chromium (Cr)	3/3	1.2 - 16.5	6.9
Cobalt (Co)	1/3	3.4	3.4
Copper (Cu)	3/3	0.78 - 10.7	4.36
Iron (Fe)	3/3	545 - 16800	6395
Lead (Pb)	3/3	1.2 - 16.2	7.07
Magnesium (Mg)	3/3	30.1 - 572	290.7
Manganese (Mn)	3/3	1.3 - 169	57.9
Nickel (Ni)	1/3	7	7
Potassium (K)	3/3	17.5 - 463	189.8
Sodium (Na)	3/3	18.6 - 805	320.2
Vanadium (V)	3/3	0.99 - 35.4	12.96
Zinc (Zn)	3/3	1.4 - 30.6	12.27
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDE	2/3	0.55 - 1.2	0.88
4,4'-DDD	1/3	0.71	0.71
4,4'-DDT	1/3	0.34	0.34
Aroclor-1260	2/3	1.1 - 4.2	2.65
delta-BHC	2/3	0.11 - 0.31	0.21
Dieldrin	2/3	0.2 - 0.21	0.21
Endosulfan I	1/3	5.3	5.3
Endrin	1/3	0.27	0.27
gamma-Chlordane	1/3	1.3	1.3
Heptachlor epoxide	2/3	0.22 - 26	13.11
<b>SVOCs (µg/kg)</b>			
Fluoranthene	1/3	28	28
Pyrene	1/3	28	28
<b>VOCs (µg/kg)</b>			
Chloromethane	1/3	2	2

**Note:**

All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-17-2  
Wetland 19  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HO	SBV Reference
<b>041M19A101</b>					
	Arsenic (MG/KG)	15.7	7.24	2.17	a,b
	Chromium (MG/KG)	16.6	52.3	0.32	a,b
	Copper (MG/KG)	10.7	18.7	0.57	a,b
	gamma-Chlordane (UG/KG)	1.3 J	1.7	0.76	a
	Lead (MG/KG)	16.2	30.2	0.54	a,b
	Nickel (MG/KG)	7 J	15.9	0.44	a,b
	Zinc (MG/KG)	30.6	124	0.25	a,b
<b>041M19B101</b>					
	4,4'-DDD (UG/KG)	0.71	1.22	0.58	b
	4,4'-DDE (UG/KG)	1.2	2.07	0.58	b
	4,4'-DDT (UG/KG)	0.34 J	1.19	0.29	b
	Aroclor-1260 (UG/KG)	4.2 J	21.6	0.19	b
	Arsenic (MG/KG)	0.81	7.24	0.11	a,b
	Chromium (MG/KG)	3	52.3	0.06	a,b
	Copper (MG/KG)	1.6 J	18.7	0.09	a,b
	Dieldrin (UG/KG)	0.21 J	0.72	0.29	b
	Endrin (UG/KG)	0.27 J	3.3	0.08	a
	Fluoranthene (UG/KG)	28 J	113	0.25	b
	Lead (MG/KG)	3.6	30.2	0.13	a,b
	Pyrene (UG/KG)	28 J	163	0.18	b
	Zinc (MG/KG)	4.6	124	0.04	a,b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 8) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.



**Table 10-17-3**  
**Phase IIA Detected Concentrations in Wetland 19 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/2	2140 - 111000	56570
Antimony (Sb)	2/2	2 - 19.2	10.6
Arsenic (As)	2/2	4.8 - 268	136.4
Barium (Ba)	2/2	7.4 - 300	153.7
Beryllium (Be)	1/2	4	4
Calcium (Ca)	2/2	17200 - 21200	19200
Chromium (Cr)	1/2	99.5	99.5
Cobalt (Co)	1/2	38.5	38.5
Copper (Cu)	1/2	41.9	41.9
Iron (Fe)	2/2	4030 - 332000	168015
Lead (Pb)	2/2	5.6 - 86.9	46.25
Magnesium (Mg)	2/2	4570 - 36400	20485
Manganese (Mn)	2/2	26.3 - 12700	6363.15
Mercury (Hg)	1/2	0.59	0.59
Nickel (Ni)	1/2	25.8	25.8
Potassium (K)	2/2	2720 - 11400	7060
Sodium (Na)	2/2	4730 - 291000	147865
Vanadium (V)	2/2	4.4 - 277	140.7
Zinc (Zn)	2/2	7.1 - 204	105.55
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
Di-n-butylphthalate	1/2	28	28

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-17-4 (1)

## Wetland 19

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UCM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W190301	Freshwater					
	Aluminum	UG/L	2,140.0	87.0	24.5977	a
	Antimony	UG/L	2.0	180.0	0.0125	a
	Arsenic	UG/L	4.8	50.0	0.096	b
	Iron	UG/L	4,030.0	1,000.0	4.03	a b
	Lead	UG/L	5.8	1.71	3.27485	a b
	Zinc	UG/L	7.1	70.2	0.10114	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### **10.17.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus many evaluations are qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-17-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-17-4.

#### **Transport into the Wetland**

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 19 through this pathway:

- Potential storm water runoff and sediment entrainment from the east end of the E-W runway at Forrest Sherman Field, and a direct surface water connection to Redoubt Bayou. Back flushing of surface water in a landward direction during high tides and storm events can be expected.

The presence of sediment contaminants above sediment benchmark levels (see Table 10-17-5) validates the sediment transport pathway, and by inference the surface water pathway. Nine inorganics and one organic parameter above surface water quality criteria further validate the pathway.

Table 10-17-5  
 Calculated Sediment Screening Values for Wetland 19

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Inorganics	(ppb)		(ppm)	(ppm)	
Arsenic	50 <sup>b</sup>	2.9E+01	145.7	15.7	NO

**Notes:**

Kd for organics calculated using foc of .064 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 19 through this pathway:

- Discharge from Sites 16, 5, and 6. Groundwater at these sites has not been shown to be contaminated, thus the pathway is considered invalid.

### Transport within the Wetland

#### Surface Water/Sediment Migration Pathway

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Redoubt Bayou. However, tidal fluctuations can create a temporary landward movement. Therefore, both sediment and surface water contaminants can be expected to remain mobile.

#### *Sediment Leaching to Surface Water Pathway*

One inorganic — arsenic — exceeded its sediment benchmark level, but it did not exceed its SSL. Aluminum, arsenic, beryllium, chromium, copper, iron, lead, mercury, and zinc were present above surface water quality criteria, and except for arsenic, are attributable to the surface water/groundwater discharge pathway. Some measure of the arsenic present in surface water may be due to partitioning from sediment. The detection of arsenic in sediment and corresponding surface water suggests that the pathway is valid, but that the potential for arsenic to partition above surface water quality criteria is low.

#### **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Bayou Redoubt, and sediment and surface water contamination will remain mobile.

#### **10.17.4 Ecological Risk Assessment**

HQs for Wetland 19 sediment samples are presented in Table 10-17-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed a HQ above 1 for arsenic (2.17). There were no other sediment inorganic or organic concentrations exceeding a HQ of 1 at Wetland 19. Phase IIA surface water results revealed HQs above 1 for aluminum (1,275.86), arsenic (5.36), beryllium (30.77), chromium (9.05), copper (5.37), iron (332.0), lead (50.82), mercury (49.17), and zinc (2.91) exceeded surface water quality criteria sample location 1901. Aluminum (24.60), iron (4.03), and lead (3.28) also had HQs above 1 at sample location 1903. The only organic detection with a HQ greater than 1 was di-n-butylphthalate (9.33), at sample location 1901.

Wetland 19 is classified as a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the

blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.17.5 Human Health Risk Assessment**

##### **10.17.5.1 Samples Included**

###### **Sediment**

041M19A101, 041M19A201, 041M19B101

###### **Surface Water**

041W190101, 041W190301

##### **10.17.5.2 Current and Future Land Use**

The area is in a sparsely populated area of the base, that is restricted to general access by the public. The area is also patrolled by base police. Exposure media includes surface water for occasional Navy or civilian workers, trespassers, or children who could find the area attractive. The adolescent trespasser and maintenance worker scenarios were considered to be conservatively representative of potential exposure populations at this site.

##### **10.17.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

##### **10.17.5.4 Sediment COPCs**

As shown in Table 10-17-6, the following sediment COPC was identified:

- Arsenic

TABLE 10-17-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 19 Sediment

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Deletion or Selection	
72548	4,4'-DDD	0.7100		0.7100		UG/KG	041M19B101	1 / 3	0.21 - 1.40	0.71	0.71	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	0.5500		1.2000		UG/KG	041M19A201	2 / 3	1.40 - 1.40	0.88	1.2	N/A	65000	40000	C	N/A	NO	BSL
50293	4,4'-DDT	0.3400	J	0.3400	J	UG/KG	041M19B101	1 / 3	0.21 - 1.40	0.34	0.34	N/A	65000	40000	C	N/A	NO	BSL
7429905	Aluminum (Al)	494.0000		18900.00		MG/KG	041M19A201	3 / 3	NAV	6790	18900	N/A	320000	490000	N	N/A	NO	BSL
11096825	Aroclor-1260	1.1000	J	4.2000	J	UG/KG	041M19A201	2 / 3	14.00 - 14.00	2.65	4.2	N/A	11000	6900	C	N/A	NO	BSL
7440382	Arsenic (As)	0.1700	J	15.70		MG/KG	041M19A101	3 / 3	NAV	6	15.7	N/A	15	9.2	C	N/A	YES	ASL
7440393	Barium (Ba)	0.5800	J	30.20	J	MG/KG	041M19B101	3 / 3	NAV	11	30.2	N/A	22000	34000	N	N/A	NO	BSL
7440417	Beryllium (Be)	0.4800	J	0.4800	J	MG/KG	041M19A101	1 / 3	0.07 - 0.07	0.48	0.48	N/A	630	980	N	N/A	NO	BSL
7440702	Calcium (Ca)	47.5000	J	1720.00		MG/KG	041M19A201	3 / 3	NAV	640	1720	N/A	N/A	N/A	N/A	N/A	NO	EN
74873	Chloromethane	2.0000	J	2.0000	J	UG/KG	041M19A201	1 / 3	13.00 - 77.00	2.00	2	N/A	1700000	1100000	C	N/A	NO	BSL
7440473	Chromium (Cr)	1.2000		16.50		MG/KG	041M19A101	3 / 3	NAV	7	16.5	N/A	1600	2500	N	N/A	NO	BSL
7440484	Cobalt (Co)	3.4000	J	3.4000	J	MG/KG	041M19A101	1 / 3	0.13 - 0.14	3.40	3.4	N/A	19000	29000	N	N/A	NO	BSL
7440508	Copper (Cu)	0.7800	J	10.70		MG/KG	041M19A201	3 / 3	NAV	4	10.7	N/A	13000	20000	N	N/A	NO	BSL
319868	delta-BHC	0.1100	J	0.3100	J	UG/KG	041M19A201	2 / 3	0.68 - 0.68	0.21	0.31	N/A	12000	7600	C	N/A	NO	BSL
60571	Dieldrin	0.2000	J	0.2100	J	UG/KG	041M19B101	2 / 3	1.40 - 1.40	0.21	0.21	N/A	1400	860	C	N/A	NO	BSL
959988	Endosulfan I	5.3000	J	5.3000	J	UG/KG	041M19A101	1 / 3	0.10 - 0.11	5.30	5.3	N/A	1900000	2900000	N	N/A	NO	BSL
72208	Endrin	0.2700	J	0.2700	J	UG/KG	041M19B101	1 / 3	0.21 - 1.40	0.27	0.27	N/A	95000	150000	N	N/A	NO	BSL
206440	Fluoranthene	28.0000	J	28.0000	J	UG/KG	041M19B101	1 / 3	40.00 - 270.00	28.00	28	N/A	13000000	20000000	N	N/A	NO	BSL
5103742	gamma-Chlordane	1.3000	J	1.3000	J	UG/KG	041M19A101	1 / 3	0.10 - 0.11	1.30	1.30	N/A	63000	39000	C	N/A	NO	BSL
1024573	Heptachlor epoxide	0.2200	J	26.0000	DJ	UG/KG	041M19B101	2 / 3	0.10 - 0.10	13.11	28	N/A	2400	1500	C	N/A	NO	BSL
7439896	Iron (Fe)	545.0000		16800.00		MG/KG	041M19A101	3 / 3	NAV	6395	16800	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	1.2000		16.20		MG/KG	041M19A101	3 / 3	NAV	7	16.2	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	30.1000	J	572.00	J	MG/KG	041M19A101	3 / 3	NAV	291	572	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	1.3000		169.00		MG/KG	041M19B101	3 / 3	NAV	58	169	N/A	15000	23000	N	N/A	NO	BSL
7440020	Nickel (Ni)	7.0000	J	7.0000	J	MG/KG	041M19A101	1 / 3	0.60 - 0.63	7.00	7	N/A	6300	9800	N	N/A	NO	BSL
7440097	Potassium (K)	17.5000	J	483.00	J	MG/KG	041M19A101	3 / 3	NAV	190	463	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	28.0000	J	28.0000	J	UG/KG	041M19B101	1 / 3	40.00 - 270.00	28.00	28	N/A	9500000	15000000	N	N/A	NO	BSL
7440235	Sodium (Na)	18.6000	J	805.00		MG/KG	041M19A101	3 / 3	NAV	320	805	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	0.9900	J	35.40		MG/KG	041M19A101	3 / 3	NAV	13	35.4	N/A	2200	3400	N	N/A	NO	BSL
7440666	Zinc (Zn)	1.4000		30.60		MG/KG	041M19B101	3 / 3	NAV	12	30.6	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background concentrations were not calculated for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented Section 8 of this report.

(6) Rationale Codes

Se Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

#### **10.17.5.5 Surface Water COPCs**

As shown in Table 10-17-7, the following surface water COPCs were identified:

- Arsenic
- Lead
- Manganese

#### **10.17.5.6 Risk Characterization**

##### ***Adolescent Trespasser***

As shown in Tables 10-17-8 and 10-17-9, arsenic is the only contributor to risk estimates for the sediment and surface water pathways under the adolescent trespasser scenario. Table 10-17-13 summarizes the risk and hazard estimates for Wetland 19. The cumulative risk estimated for this wetland is  $2.5E-5$ . Arsenic and manganese were the primary contributors to hazard index for the adolescent trespasser scenario. The hazard index was estimated to be 1.2. Arsenic was identified as a COC for both sediment and surface water based on its contribution to the cumulative risk estimate for this wetland. Arsenic and manganese were identified as COCs for surface water based on their contribution to hazard index estimates. Tables 10-17-8 through 10-17-12 detail cancer risk estimates and noncancer hazard estimates for this wetland under an adolescent trespasser scenario. Although exposure would likely be acute or subchronic, these hazard estimates were developed for completeness, and RGOs were developed below. Risk managers could consider game fish tissue data from the lower end of Wetland 19 to be a data gap.

##### ***Maintenance Worker***

As shown in Tables 10-17-13 and 10-17-15, arsenic is the only contributor to risk estimates for the sediment and surface water pathways under the maintenance worker scenario. Table 10-17-17 summarizes the risk and hazard estimates for Wetland 19. The cumulative risk estimated for this wetland is  $4E-5$  and the hazard index was estimated to be 0.4. Arsenic was identified as a COC for both sediment and surface water based on its contribution to the cumulative risk estimate for this wetland. Tables 10-17-13 through 10-17-16 detail cancer and noncancer hazard estimates for this wetland under a maintenance worker scenario.



TABLE 10-17-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 19 Surface Water

CAS Number	Chemical	(1)	(1)			Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	Background Value	(3)	(4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier								Adolescent Site Trespasser PRG	Commercial Maintenance Worker PRG				
7429905	Aluminum (Al)	2140.000		111000.0000		UG/L	041W190101	2 / 2	NAV	56570.00	111000	N/A	120000	250000	N	N/A	NO	BSL
7440360	Antimony (Sb)	2.000	J	19.2000	J	UG/L	041W190101	2 / 2	NAV	10.60	19.2	N/A	48	100	N	N/A	NO	BSL
7440382	Arsenic (As)	4.800	J	268.0000		UG/L	041W190101	2 / 2	NAV	136.40	268	N/A	5.6	4.7	C	N/A	YES	ASL
7440393	Barium (Ba)	7.400	J	300.0000		UG/L	041W190101	2 / 2	NAV	153.70	300	N/A	8300	18000	N	N/A	NO	BSL
7440417	Beryllium (Be)	4.000	J	4.0000		UG/L	041W190101	1 / 2	NAV	4.00	4	N/A	240	500	C	N/A	NO	BSL
7440702	Calcium (Ca)	17200.000		21200.0000		UG/L	041W190101	2 / 2	NAV	19200.00	21200	N/A	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	99.500		99.5000		UG/L	041W190101	1 / 2	NAV	99.50	99.5	N/A	360	760	N	N/A	NO	BSL
7440484	Cobalt (Co)	38.500	J	38.5000		UG/L	041W190101	1 / 2	NAV	38.50	38.5	N/A	7100	15000	N	N/A	NO	BSL
7440508	Copper (Cu)	41.900		41.9000		UG/L	041W190101	1 / 2	NAV	41.90	41.9	N/A	4800	10000	N	N/A	NO	BSL
84742	Di-n-butylphthalate	28.000		28.0000		UG/L	041W190101	1 / 2	NAV	28.00	28	N/A	460	1500	N	N/A	NO	BSL
7439898	Iron (Fe)	4030.000		332000.0000		UG/L	041W190101	2 / 2	NAV	168015.00	332000	N/A	N/A	N/A	N	N/A	NO	EN
7439921	Lead (Pb)	5.800		86.9000		UG/L	041W190101	2 / 2	NAV	46.25	86.9	N/A	15	15	N	N/A	YES	ASL
7439954	Magnesium (Mg)	4570.000	J	36400.0000		UG/L	041W190301	2 / 2	NAV	20485.00	36400	N/A	N/A	N/A	N/A	N/A	NO	EN
7439985	Manganese (Mn)	26.300		12700.0000		UG/L	041W190101	2 / 2	NAV	6363.15	12700	N/A	2400	5000	N	N/A	YES	ASL
7439976	Mercury (Hg)	0.590		0.5900		UG/L	041W190101	1 / 2	NAV	0.59	0.59	N/A	36	76	N	N/A	NO	BSL
7440020	Nickel (Ni)	25.800	J	25.8000		UG/L	041W190101	1 / 2	NAV	25.80	25.8	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	2720.000	J	11400.0000		UG/L	041W190301	2 / 2	NAV	7060.00	11400	N/A	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	4730.000	J	291000.0000		UG/L	041W190301	2 / 2	NAV	147885.00	291000	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	4.400	J	277.0000		UG/L	041W190101	2 / 2	NAV	140.70	277	N/A	830	1800	N	N/A	NO	BSL
7440668	Zinc (Zn)	7.100	J	204.0000		UG/L	041W190101	2 / 2	NAV	105.55	204	N/A	36000	76000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) RBCs for adolescent site trespasser scenario calculated using values presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(4) RBCs for commercial maintenance worker scenario calculated using values presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-17-8  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current Medium: Sediment Exposure Medium: Sediment Exposure Point: Wetland 19 Receptor Population: Trespasser Receptor Age: Adolescent
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Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	15.7	MG/KG	N/A	M	7.10E-07	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	1.07E-06
Dermal	Arsenic	15.7	MG/KG	N/A	M	2.90E-08	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	2.18E-07
Total Risk All Exposure Routes/Pathways										1.28E-06

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-9  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 19  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	15.7	MG/KG	N/A	M	5.00E-06	mg/kg-day	3.00E-04	mg/kg-day	0.0167
Dermal	Arsenic	15.7	MG/KG	N/A	M	2.00E-07	mg/kg-day	6.00E-05	mg/kg-day	0.0033
Total Hazard Index Across All Exposure Routes/Pathways										0.020

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-10  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future Medium: Surface water Exposure Medium: Surface water Exposure Point: Wetland 19 Receptor Population: Trespasser Receptor Age: Adolescent
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Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.268	MG/L	N/A	M	1.60E-05	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	2.40E-05
Dermal	Arsenic	0.268	MG/L	N/A	M	3.28E-06	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	2.46E-05
Total Risk										4.86E-05

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-11  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 19  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.268	MG/L	N/A	M	1.10E-04	mg/kg-day	3.00E-04	mg/kg-day	0.37
	Manganese	12.7	MG/L	N/A	M	5.22E-03	mg/kg-day	2.30E-02	mg/kg-day	0.23
Dermal	Arsenic	0.268	MG/L		M	2.29E-05	mg/kg-day	6.00E-05	mg/kg-day	0.38
	Manganese	12.7	MG/L		M	1.09E-03	mg/kg-day	4.60E-03	mg/kg-day	0.24
Total Hazard Index										1.21

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-12  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future Receptor Population: Site Trespasser Receptor Age: Adolescent
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Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient				
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total	
Sediment	Sediment	Wetland 19	Arsenic	1.07E-06	2.18E-07	1.28E-06	Arsenic	skin	0.017	0.0033	0.020	
			(Total)	1.07E-06	2.18E-07	1.28E-06			(Total)	0.017	0.0033	0.020
Surface Water	Surface Water	Wetland 19	Arsenic	2.40E-05	2.46E-05	2.40E-05	Arsenic Manganese	skin	0.37	0.38	0.75	
			(Total)	2.40E-05	2.46E-05	2.40E-05		(Total)	Central nervous system	0.23	0.24	0.46
									0.59	0.62	1.21	
Total Risk Across All Pathways						2.53E-05	Total Hazard Index Across All Pathways					1.23

TABLE 10-17-13  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 19  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	15.7	MG/KG	N/A	M	1.10E-06	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	1.65E-06
Dermal	Arsenic	15.7	MG/KG	N/A	M	4.70E-08	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	3.53E-07
<b>Total Risk All Exposure Routes/Pathways</b>										<b>2.00E-06</b>

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-14  
CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Welland 19  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	15.7	MG/KG	N/A	M	3.20E-06	mg/kg-day	3.00E-04	mg/kg-day	0.011
Dermal	Arsenic	15.7	MG/KG	N/A	M	1.30E-07	mg/kg-day	6.00E-05	mg/kg-day	0.0022
Total Hazard Index Across All Exposure Routes/Pathways										0.013

EPC = Exposure Point Concentration

MG/KG = Milligram per Kilogram

M = Medium-specific EPC selected for risk calculation.



TABLE 10-17-15  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future Medium: Surface water Exposure Medium: Surface water Exposure Point: Wetland 19 Receptor Population: Maintenance Worker Receptor Age: Adult
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Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.268	MG/L	N/A	M	2.50E-05	mg/kg-day	1.5	(mg/kg-day) <sup>-1</sup>	3.75E-05
Dermal	Arsenic	0.268	MG/L	N/A	M	2.53E-06	mg/kg-day	7.5	(mg/kg-day) <sup>-1</sup>	1.90E-05
Total Risk										5.65E-05

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-16  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future Medium: Surface Water Exposure Medium: Surface Water Exposure Point: Wetland 19 Receptor Population: Trespasser Receptor Age: Adolescent
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Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Arsenic	0.268	MG/L	N/A	M	7.10E-05	mg/kg-day	3.00E-04	mg/kg-day	0.237
	Manganese	12.7	MG/L	N/A	M	3.36E-03	mg/kg-day	2.30E-02	mg/kg-day	0.146
Dermal	Arsenic	0.268	MG/L		M	7.09E-06	mg/kg-day	6.00E-05	mg/kg-day	0.118
	Manganese	12.7	MG/L		M	3.36E-04	mg/kg-day	4.60E-03	mg/kg-day	0.0730
Total Hazard Index										0.57

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

TABLE 10-17-17  
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Receptor Population: Maintenance Worker  
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			Chemical	Non-carcinogenic Hazard Quotient			
				Ingestion	Dermal Contact	Total		Primary Target Organ	Ingestion	Dermal Contact	Total
Sediment	Sediment	Wetland 19	Arsenic	1.65E-06	3.53E-07	2.00E-06	Arsenic	skin	0.011	0.0022	0.013
			(Total)	1.65E-06	3.53E-07	2.00E-06	(Total)		0.011	0.0022	0.013
Surface Water	Surface Water	Wetland 19	Arsenic	3.75E-05	1.90E-05	5.65E-05	Arsenic	skin	0.237	0.118	0.237
			(Total)	3.75E-05	1.90E-05	5.65E-05	Manganese (Total)	central nervous system	0.146	0.073	0.146
Total Risk Across All Wetlands						5.85E-05	Total Hazard Index Across All Wetlands				0.40

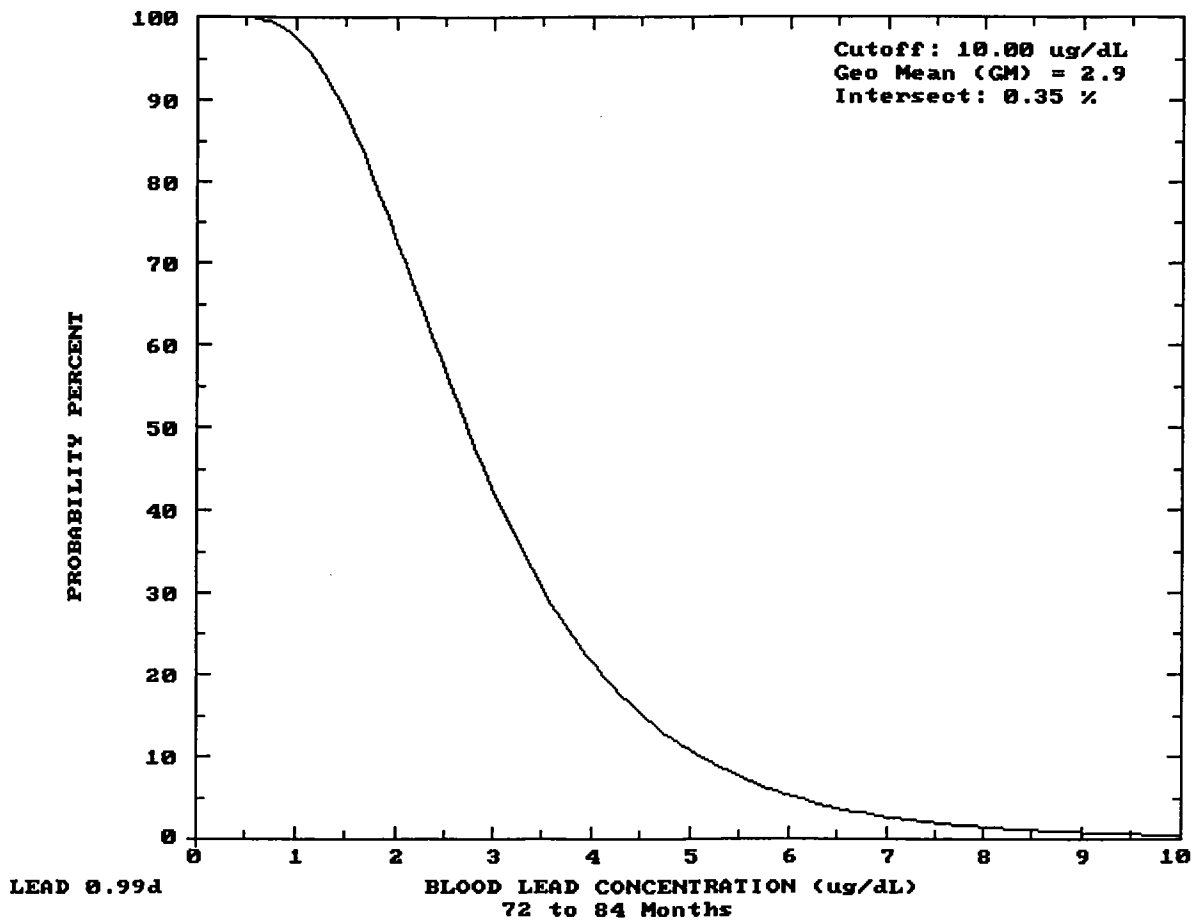
### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 19. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for the year. Exposure to Wetland 19 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's place of residence. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the lead model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 19.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water per visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 19 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of 268  $\mu\text{g/L}$ , the annual alternate source exposure was estimated to be 1.91  $\mu\text{g}$  lead/day. Table 10-17-18 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-17-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 2.9  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.35%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, surface water lead concentrations at Wetland 19 would not require specific action under the hypothetical exposure scenario.

Figure 10-17-2 Probability Percentage of Blood Lead Levels



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Table 10-17-18  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 19  
 Pensacola, Florida

AIR CONCENTRATION: 0.100  $\mu\text{g Pb/m}^3$  DEFAULT  
 Indoor AIR Pb Conc: 30.0 percent of outdoor.  
 Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m <sup>3</sup> /day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb/L}$  DEFAULT  
 WATER Consumption: DEFAULT

SOIL & DUST:  
 Soil: constant conc.  
 Dust: constant conc.

Age	Soil ( $\mu\text{g Pb/g}$ )	House Dust ( $\mu\text{g Pb/g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 19 surface water  
 6-7: 1.91  $\mu\text{g Pb/day}$

MATERNAL CONTRIBUTION: Infant Model  
 Maternal Blood Conc: 2.50  $\mu\text{g Pb/dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g/dL}$ )	Total Uptake ( $\mu\text{g/day}$ )	Soil + Dust Uptake ( $\mu\text{g/day}$ )	Diet Uptake ( $\mu\text{g/day}$ )	Water Uptake ( $\mu\text{g/day}$ )	Alt. Source Uptake ( $\mu\text{g/day}$ )	Air Uptake ( $\mu\text{g/day}$ )
0.5-1	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7	2.9	10.35	4.87	3.34	1.13	0.91	0.09

#### **10.17.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Arsenic was identified as a COC for both sediment and surface water for Wetland 19. Because arsenic was identified as a COC for both media based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed.

##### ***Adolescent Trespasser***

As shown in Table 10-17-8, the maximum sediment concentration of 15.7 mg/kg-day, used as an exposure point concentration, resulted in a risk estimate of 1.3E-6 for arsenic. Using a linear ratio, a target risk of 1E-6 would result from 12.24 mg/kg. Therefore, 122.4 mg/kg and 1224 mg/kg represent target risks of 1E-5 and 1E-4, respectively.

An exposure point concentration of 0.268 mg/L for arsenic in surface water resulted in a risk estimate of 2.4E-5, as shown in Table 10-17-10. Using a linear ratio, 0.0056 mg/L would correspond with a target risk of 1E-6. Therefore, 0.056 mg/L and 0.56 mg/L represent target risks of 1E-5 and 1E-4, respectively. An exposure point concentration of 0.268 mg/L for arsenic in surface water resulted in a hazard estimate of 0.77, as shown in Table 10-17-10. Using a linear ratio, 0.36 mg/L would correspond with a target hazard of 1. Therefore, 0.036 mg/L and 1.08 mg/L represent target hazards of 0.1 and 3, respectively. An exposure point concentration of 12.7 mg/L for manganese in surface water resulted in a hazard estimate of 0.46, as shown in Table 10-17-10. Using a linear ratio, 24 mg/L would correspond with a target hazard of 1. Therefore, 2.4 mg/L and 72 mg/L represent target hazards of 0.1 and 3, respectively.

##### ***Maintenance Worker***

As shown in Table 10-17-13, the sediment exposure point concentration of 15.7 mg/kg-day resulted in a risk estimate of 2E-6 for arsenic. Using a linear ratio, a target risk of 1E-6 would



result from 7.48 mg/kg. Therefore, 74.8 mg/kg and 748 mg/kg represent target risks of  $1\text{E-}5$  and  $1\text{E-}4$ , respectively. A surface water exposure point concentration of 0.268 mg/L resulted in a risk estimate of  $5.65\text{E-}5$ , as shown in Table 10-7-15. Using a linear ratio, 0.0047 mg/L would correspond with a target risk of  $1\text{E-}6$ . Therefore, 0.047 mg/L and 0.47 mg/L represent target risks of  $1\text{E-}5$  and  $1\text{E-}4$ , respectively.

#### **10.17.6 Conclusions and Recommendations**

Wetland 19 was classified as a blue-coded wetland because contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to an IR site.

The HHRA identified arsenic as the only sediment COC at Wetland 19. The HHRA also identified arsenic, lead and manganese as surface water COCs.

Based on the isolated exceedance of the beachmark level, Wetland 19 was recommended and approved for NFA. As documented in the September 18, 1996 Eco Meeting Minutes, and the September 19 and 20, 1996 Partnering Team Minutes,

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## **10.18 WETLAND 52**

### **10.18.1 Site Description**

Wetland 52 is at the southern end of Forrest Sherman Field and on the northern side of Radford Blvd., encompassing an area of approximately 100 acres. Parsons and Pruitt divided this wetland into five distinct areas, Wetlands 52A, 52B, 52C, 52D, and 52E (USEPA, 1991). All sites are palustrine in nature, with vegetative types from emergent to forested scrub-shrub.

A stream passes west to east along the border between Wetlands 52A and 52B. This stream continues across both sections of Wetland 52D, through Wetland 52E, emptying into Sherman's Inlet after passing under Radford Blvd. This stream originates in Wetland 48 and follows a topographic low across Wetlands 52 A/B, which contains a dense titi forest. Surface water from the southern half of Wetland W1 also drains into Wetland 52A. Wetland W1 is located to the west of the north/south runway of Forrest Sherman Field, near UST 18 (the former Crash Crew Training Area). The area between Wetland 52D east and west is mowed and maintained as an emergency overrun for the north/south runway at the nearby airfield. Wetland 52D is saturated year round. The stream running through Wetland 52 ultimately discharges into Sherman's Inlet, and is tidally influenced in its lower portions.

The IR site potentially affecting Wetland 52 is UST 18, the former crash crew training area. Contamination at UST 18 was determined to not be migrating offsite, and natural attenuation was selected and approved as the remedial action.

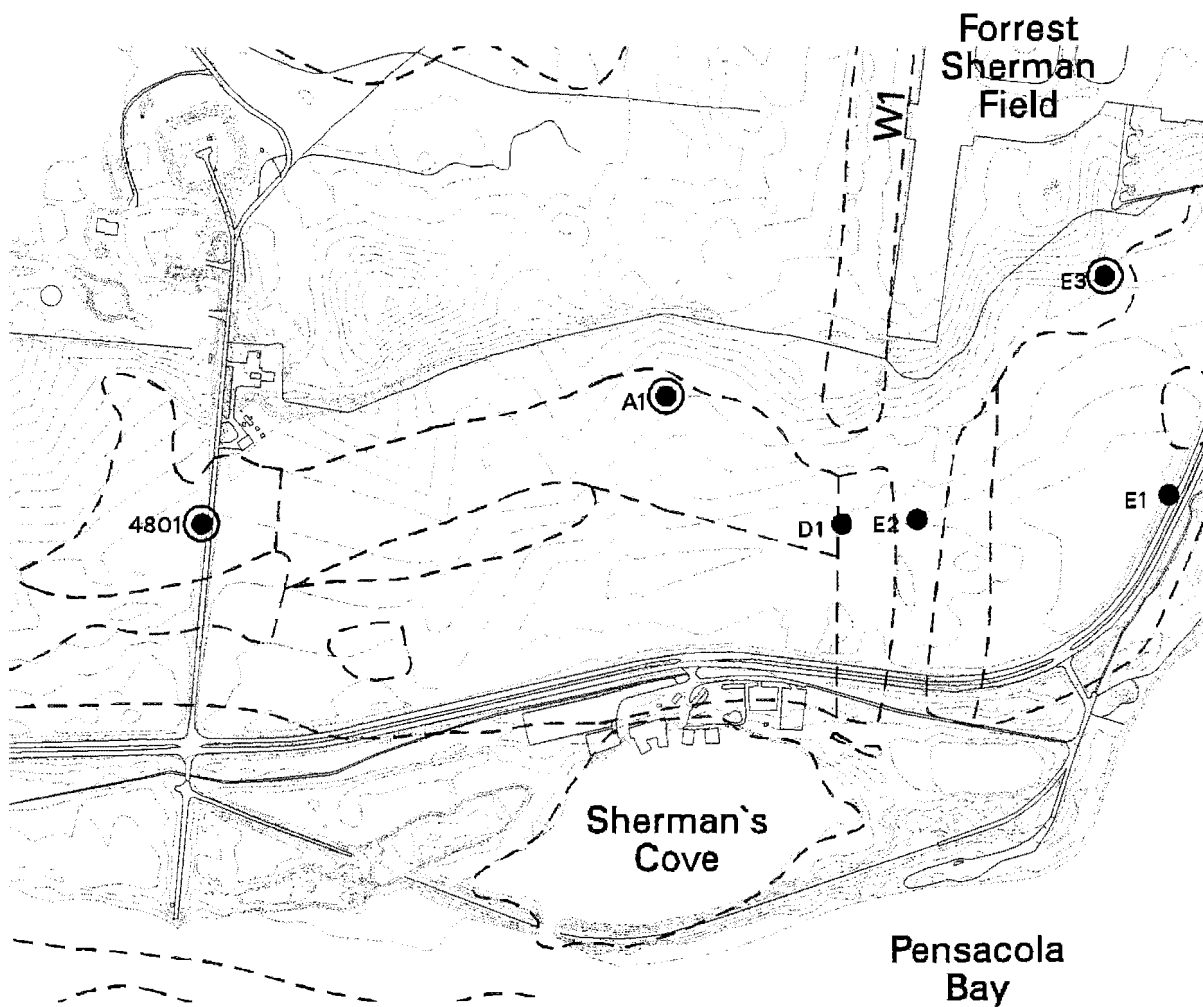
### **10.18.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-18-1 denotes the Phase IIA Wetland 52 sampling locations.

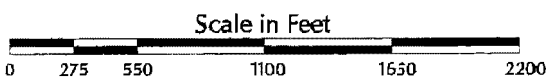
## **Sediment**

Seventeen metals were detected in Wetland 52 sediment samples. No metals exceeded a sediment benchmark level at Wetland 52. Thirteen pesticides detected in Wetland 52 sediment samples, including 4,4'-DDT and its metabolites, aldrin, dieldrin, endosulfan I, endosulfan sulfate, endrin, alpha/delta/gamma-BHC, and alpha/gamma-chlordane. No concentration of 4,4'-DDT or its metabolites exceeded basewide levels (see Section 6). Dieldrin exceeded its sediment benchmark level (0.72 ppb) at sample location 52A1 (9.5 ppb), and gamma-BHC exceeded its sediment level (0.32 ppb) at 52E1 (0.43 ppb). The PCB Aroclor-1260 was also detected in Wetland 52 sediment samples below its benchmark level. Twenty SVOCs were detected in Wetland 52 sediment samples, including 16 high and low molecular weight PAHs. Nine PAHs exceeded appropriate sediment benchmark criteria, including benzo(a)anthracene (100 ppb), chrysene (130 ppb), and fluoranthene (140 ppb) at sample location 52E1, and 2-methylnaphthalene (50 ppb), acenaphthene (77 ppb), anthracene (100 ppb), fluoranthene (130 ppb), fluorene (94 ppb), naphthalene (100 ppb), and phenanthrene (240 ppb) at sample location 52E3. Bis(2-ethylhexyl)phthalate was also detected above its sediment benchmark level (182 ppb) at sample locations 52A1 (360 ppb) and 52E1 (260 ppb). Two VOCs, acetone (a common laboratory contaminant) and toluene, were detected in Wetland 52 sediment samples.

Table 10-18-1 shows the Wetland 52 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-18-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only detected parameters with benchmark levels are presented in Table 10-18-2. The HQs will be further discussed in the ecological risk section (Section 10.18.4).



- Sediment Sample Location
- Surface Water Sample Collected
- - - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-18-1  
PHASE IIA WETLAND 48 & 52  
SAMPLING LOCATIONS**

Table 10-18-1  
 Phase IIA Detected Concentrations in Wetland 52 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	5/5	667 - 6230	3061.4
Arsenic (As)	1/5	0.31	0.31
Barium (Ba)	5/5	2.2 - 43.3	14.98
Calcium (Ca)	5/5	526 - 3670	1897.2
Chromium (Cr)	5/5	1.2 - 6.7	3.32
Cobalt (Co)	3/5	0.21 - 1.4	0.62
Copper (Cu)	5/5	0.92 - 6.4	2.984
Iron (Fe)	5/5	361 - 2300	1158.6
Lead (Pb)	5/5	2.6 - 17.7	7.36
Magnesium (Mg)	5/5	110 - 1280	613
Manganese (Mn)	5/5	2 - 15.8	9.08
Nickel (Ni)	4/5	0.99 - 5.2	2.35
Potassium (K)	5/5	22.2 - 160	80.46
Selenium (Se)	4/5	0.73 - 10.2	3.69
Sodium (Na)	3/5	61.1 - 169	124.37
Vanadium (V)	5/5	1.1 - 6.6	4.1
Zinc (Zn)	4/5	3.2 - 25.5	11.18
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	3/5	0.45 - 6.1	2.35
4,4'-DDE	1/5	7	7
4,4'-DDT	1/5	1.3	1.3
Aldrin	1/5	2.8	2.8
Aroclor-1260	2/5	3.3 - 3.7	3.5
Dieldrin	1/5	9.5	9.5
Endosulfan I	2/5	0.39 - 5.7	3.05
Endosulfan sulfate	1/5	1.2	1.2
Endrin	2/5	1.7 - 2.4	2.05
alpha-BHC	1/5	0.14	0.14
alpha-Chlordane	1/5	0.34	0.34

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-18-1  
 Phase IIA Detected Concentrations in Wetland 52 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Pesticides and PCBs (<math>\mu\text{g/kg}</math>) (Continued)</b>			
delta-BHC	1/5	0.61	0.61
gamma-BHC (Lindane)	1/5	0.43	0.43
gamma-Chlordane	1/5	0.91	0.91
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Methylnaphthalene	1/5	50	50
4-Methylphenol (p-Cresol)	2/5	110 - 170	140
Acenaphthene	1/5	77	77
Anthracene	1/5	100	100
Benzo(a)anthracene	2/5	26 - 100	63
Benzo(a)pyrene	1/5	64	64
Benzo(b)fluoranthene	1/5	190	190
Benzo(g,h,i)perylene	1/5	45	45
Benzo(k)fluoranthene	1/5	61	61
Carbazole	1/5	45	45
Chrysene	1/5	130	130
Di-n-butylphthalate	3/5	49 - 150	89
Dibenzofuran	1/5	72	72
Fluoranthene	2/5	130 - 140	135
Fluorene	1/5	94	94
Indeno(1,2,3-cd)pyrene	1/5	51	51
Naphthalene	1/5	100	100
Phenanthrene	1/5	240	240
Pyrene	2/5	82 - 140	111
bis(2-Ethylhexyl)phthalate (BEHP)	5/5	50 - 360	192
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
Acetone	1/5	1300	1300
Toluene	1/5	21	21

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

**Table 10-18-2**  
**Wetland 52**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>D41M52A101</b>					
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	360 J	182	1.98	b
	Chromium (MG/KG)	4.2 J	52.3	0.08	a b
	Copper (MG/KG)	3.9 J	18.7	0.21	a b
	Dieldrin (UG/KG)	9.5 J	0.72	13.19	b
	gamma-Chlordane (UG/KG)	0.9 J	1.7	0.54	a
	Lead (MG/KG)	7.1	30.8	0.24	a b
<b>D41M52E101</b>					
	4,4'-DDD (UG/KG)	6.1 DJ	1.22	5.00	c
	4,4'-DDE (UG/KG)	7.0	2.07	3.38	b
	4,4'-DDT (UG/KG)	1.3	1.19	1.09	b
	Benzo(a)anthracene (UG/KG)	100	74.8	1.34	b
	Benzo(a)pyrene (UG/KG)	64	88.8	0.72	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	260 J	182	1.43	b
	Chromium (MG/KG)	1.6	52.3	0.03	a b
	Chrysene (UG/KG)	139	108	1.20	b
	Copper (MG/KG)	2 J	18.7	0.11	a b
	Fluoranthene (UG/KG)	140	113	1.24	b
	gamma-BHC (Lindane) (UG/KG)	0.43 J	0.32	1.34	b
	Lead (MG/KG)	3.7	30.2	0.19	a b
	Nickel (MG/KG)	0.99 J	15.9	0.06	a b
	Pyrene (UG/KG)	140	153	0.92	b
	Zinc (MG/KG)	5.3	124	0.04	a b
<b>D41M52E201</b>					
	4,4'-DDD (UG/KG)	0.51 J	1.22	0.42	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding  
 Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 10 ppb

Basewide level for 4,4'-DDD is 50 ppb

Basewide level for 4,4'-DDT is 20 ppb



Table 10-18-2

## Wetland 52

## Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
10/10/01	2-Methylnaphthalene (UG/KG)	50	20.2	2.48	b
10/10/01	Acenaphthene (UG/KG)	77	6.71	11.48	b
10/10/01	Anthracene (UG/KG)	100	46.9	2.13	(b)
10/10/01	Arsenic (MG/KG)	0.3 (J)	7.24	0.04	a b
10/10/01	Benzo(a)anthracene (UG/KG)	26 (J)	74.8	0.35	(b)
10/10/01	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	50 (J)	182	0.27	(b)
10/10/01	Chromium (MG/KG)	2.9	52.3	0.06	a b
10/10/01	Copper (MG/KG)	1.7 (J)	18.7	0.09	a b
10/10/01	Fluoranthene (UG/KG)	130	113	1.15	(b)
10/10/01	Fluorene (UG/KG)	84	21.2	4.43	(b)
10/10/01	Lead (MG/KG)	2.6	30.2	0.09	a b
10/10/01	Naphthalene (UG/KG)	100	34.6	2.89	(b)
10/10/01	Nickel (MG/KG)	1.8 (J)	15.9	0.10	a b
10/10/01	Phenanthrene (UG/KG)	240	85.7	2.77	(b)
10/10/01	Pyrene (UG/KG)	82	153	0.54	(b)
10/10/01	Zinc (MG/KG)	35.5	124	0.21	a b

## 1041M52E301

2-Methylnaphthalene (UG/KG)	50	20.2	2.48	b
Acenaphthene (UG/KG)	77	6.71	11.48	b
Anthracene (UG/KG)	100	46.9	2.13	(b)
Arsenic (MG/KG)	0.3 (J)	7.24	0.04	a b
Benzo(a)anthracene (UG/KG)	26 (J)	74.8	0.35	(b)
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	50 (J)	182	0.27	(b)
Chromium (MG/KG)	2.9	52.3	0.06	a b
Copper (MG/KG)	1.7 (J)	18.7	0.09	a b
Fluoranthene (UG/KG)	130	113	1.15	(b)
Fluorene (UG/KG)	84	21.2	4.43	(b)
Lead (MG/KG)	2.6	30.2	0.09	a b
Naphthalene (UG/KG)	100	34.6	2.89	(b)
Nickel (MG/KG)	1.8 (J)	15.9	0.10	a b
Phenanthrene (UG/KG)	240	85.7	2.77	(b)
Pyrene (UG/KG)	82	153	0.54	(b)
Zinc (MG/KG)	35.5	124	0.21	a b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

## Surface Water

Eleven metals were detected in Wetland 52 surface water samples. Aluminum exceeded its water quality criteria (87 ppb) at sample locations 52A1 (116 ppb) and 52E1 (2,580 ppb). Iron also exceeded the appropriate surface water quality criteria (1,000 ppb) at sample location 52E3 (1,220 ppb). No organics were detected in Wetland 52 surface water samples.

Table 10-18-3 shows the Wetland 52 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-18-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are listed in Table 10-18-4. The HQs will be further discussed in the ecological risk section (Section 10.18.4).

Table 10-18-3  
 Phase IIA Detected Concentrations in Wetland 52 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/2	116 - 2580	1348
Barium (Ba)	2/2	4.9 - 6.6	5.75
Calcium (Ca)	2/2	808 - 10800	5804
Copper (Cu)	1/2	6.4	6.4
Iron (Fe)	1/2	1220	1220
Magnesium (Mg)	2/2	854 - 912	883
Manganese (Mn)	2/2	8.2 - 10.5	9.35
Potassium (K)	2/2	349 - 589	469
Sodium (Na)	2/2	2670 - 5260	3965
Vanadium (V)	1/2	2.7	2.7
Zinc (Zn)	1/2	12.4	12.4

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

Table 10-18-4 (1)  
**Wetland 52**  
**Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W52E301	Freshwater					
Aluminum		UG/L	2,580.0	57.0	29.85517	a
Iron		UG/L	1,220.0	1,000.0	1.22	a,b
Zinc		UG/L	12.4	70.2	0.17664	a,b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### **10.18.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking: thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-18-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-18-4.

#### **Transport into the Wetland**

##### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 52 through this pathway:

- Potential storm water runoff and sediment entrainment from the UST Sites S (the jet fuel pipeline associated with IR Site 19), O (UST-18; the former crash crew training area), and from the south end of the north/south runway at Forrest Sherman Field. Additionally, there is a direct surface water connection with Pensacola Bay, and back flushing of surface water will occur during periods of high tides and storm surge.

The presence of sediment contaminants above benchmark levels (see Table 10-18-2) validates the sediment transport pathway, and by inference the surface water pathway. Additionally, the presence of one inorganic present in surface water above standards further validates the pathway.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-18-5  
 Calculated Sediment Screening Values for Wetland 52

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)		(ppb)	(ppb)	
4,4 DDE	10.5 <sup>a</sup>	6.87E+04	7.21E+07	7	NO
4,4 DDD	0.0064 <sup>a</sup>	1.54E+04	9.86E+03	6.1	NO
4,4 DDT	0.001 <sup>a, b</sup>	4.04E+04	4.04E+03	1.3	NO
Dieldrin	0.0019 <sup>a, b</sup>	3.29E+02	62.53	9.5	NO
Gamma BHC	0.08 <sup>a, b</sup>	16.46	132.75	0.43	NO
Gamma-Chlordane	0.0043 <sup>a, b</sup>	1.85E+04	7.4E+03	0.91	NO
2-methylnaphthalene	NA	1.15E+02	NA	50	NA
Anthracene	110,000 <sup>b</sup>	4.54E+02	5E+06	100	NO
Acenaphthene	17 <sup>a</sup>	1.2E+02	2.04E+05	77	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	6.11E+03	1.89E+04	100	NO
Chrysene	0.031 <sup>b</sup>	6.11E+03	1.89E+04	130	NO
Fluoranthene	39.8 <sup>a</sup>	1.65E+03	6.57E+06	140	NO
Fluorene	14,000 <sup>b</sup>	2.12E+02	2.97E+08	94	NO
Naphthalene	62 <sup>a</sup>	3.07E+01	1.9E+05	100	NO
Phenanthrene	0.031 <sup>b</sup>	4.61E+02	1.43E+03	240	NO
Bis(2-ethylhexyl)phthalate	0.3 <sup>a</sup>	2.32E+05	6.96E+06	360	NO

Notes:

Kd for organics calculated using foc of 0.154 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 52 through this pathway:

- Discharge from UST O. Groundwater at this site has been shown to be contaminated, thus the pathway is considered valid.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway:*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Pensacola Bay. However, tidal fluctuations can create a temporary landward movement. Therefore, both sediment and surface water contaminants can be expected to remain mobile.

#### *Sediment Leaching to Surface Water Pathway*

Five pesticides and 10 semivolatiles exceeded their benchmark levels, but none exceeded their SSL and corresponding detections of these constituents in surface water were not noted. Aluminum and iron were the only parameters in surface water above standards, and they are likely attributable to the surface water/groundwater discharge pathway. Given the lack of parameters above SSLs and surface water standards, this pathway is considered invalid.

### **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Pensacola Bay, and sediment and surface water contamination.

#### **10.18.4 Ecological Risk Assessment**

HQs for Wetland 52 sediment samples are presented in Table 10-18-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed HQs above 1 for the pesticides 4,4'-DDD (5.0), 4,4'-DDE (3.38), and 4,4'-DDT (1.09) at sample location 52E1, respectively. However, as noted in the nature and extent discussion, these concentrations of 4,4'-DDT and its metabolites were below basewide levels. Other pesticides with HQs greater than 1 included: dieldrin (13.19) at sample location 52A1, and gamma-BHC (1.34) at 52E1. Nine PAHs had HQs greater than 1, including benzo(a)anthracene (1.34), chrysene (1.20), and fluoranthene (1.24) at sample location 52E1, and 2-methylnaphthalene (2.48), acenaphthene (11.48), anthracene (2.13), fluoranthene (1.15), fluorene (4.43), naphthalene (2.89), and phenanthrene (2.77) at sample location 52E3. HQs were above 1 for bis(2-ethylhexyl)phthalate at sample locations 52A1 (1.98) and 52E1 (1.43). Phase IIA surface water results revealed HQs above 1 for aluminum at sample locations 52A1 (1.33) and 52E1 (29.66). The HQ was also greater than 1 for iron at sample location 52E3 (1.22). HQs greater than 1 indicate the potential for excess risk.

Wetland 52 is a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.18.5 Human Health Risk Assessment**

##### **10.18.5.1 Samples Included**

###### **Sediment**

041M52A101, 041M52D101, 041M52E101, 041M52E201, 041M52E301

## **Surface Water**

041W52A101, 041W52E301

### **10.18.5.2 Current and Future Land Use**

Wetland 52 is south of Forrest Sherman Field, and is inaccessible to the public due to its locality, and the dense vegetation and swampy conditions within the wetland. A gravel access road, not open to the public, traverses the north side of Wetland 52A. A wide grassy median separates the wetland from Radford Blvd. Wetland 52D is encompassed by a runway over run for the airfield. The area surrounding Wetland 52E is largely swampy. An occasional trespasser might visit the area, and maintenance workers occasionally clear vegetation out of drainage ditches traversing the area.

### **10.18.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

### **10.18.5.4 Sediment COPCs**

As shown in Table 10-18-6, no sediment COPCs were identified.

### **10.18.5.5 Surface Water COPCs**

As shown in Table 10-18-7, no surface water COPCs were identified.

### **10.18.5.6 Risk Summary**

No COPCs were identified for Wetland 52; therefore no formal human health risk assessment was conducted for Wetland 52.



TABLE 10-18-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 52 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adjacent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	Rationale for Containment Detection or Selection	
91576	2-Methylnaphthalene	50.0000		50.0000		UG/KG	041M52E301	1 / 5	52.00 - 270.00	50	50	N/A	6300000	95000000	N	N/A	NO	BSL
72548	4,4'-DDD	0.4500	J	6.1000	DJ	UG/KG	041M52E101	3 / 5	0.24 - 1.40	2.35	6.1	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	7.0000	D	7.0000	D	UG/KG	041M52E101	1 / 5	0.24 - 1.40	7	7	N/A	65000	41000	C	N/A	NO	BSL
50293	4,4'-DDT	1.3000		1.3000		UG/KG	041M52E101	1 / 5	0.24 - 1.40	1.3	1.3	N/A	65000	41000	C	N/A	NO	BSL
106445	4-Methylphenol (p-Cresol)	110.0000	J	170.0000	J	UG/KG	041M52E101	2 / 5	480.00 - 2700.00	140	170	N/A	1600000	25000000	N	N/A	NO	BSL
83328	Acenaphthene	77.0000		77.0000		UG/KG	041M52E301	1 / 5	25.00 - 130.00	77	77	N/A	19000000	29000000	N	N/A	NO	BSL
67641	Acetone	1300.0000		1300.0000		UG/KG	041M52A101	1 / 5	29.00 - 200.00	1300	1300	N/A	32000000	48000000	N	N/A	NO	BSL
309002	Aldrin	2.8000	J	2.8000	J	UG/KG	041M52A101	1 / 5	0.12 - 0.22	2.8	2.8	N/A	1300	810	C	N/A	NO	BSL
319846	alpha-BHC	0.1400	J	0.1400	J	UG/KG	041M52E301	1 / 5	0.13 - 0.69	0.14	0.14	N/A	3500	2200	C	N/A	NO	BSL
5103719	alpha-Chlordane	0.3400	J	0.3400	J	UG/KG	041M52E201	1 / 5	0.12 - 0.69	0.34	0.34	N/A	53000	39000	C	N/A	NO	BSL
7429905	Aluminum (Al)	667.0000		6230.00		MG/KG	041M52A101	5 / 5	NAV	3061.4	6230	N/A	320000	490000	N	N/A	NO	BSL
120127	Anthracene	100.0000		100.0000		UG/KG	041M52E301	1 / 5	52.00 - 270.00	100	100	N/A	95000000	150000000	N	N/A	NO	BSL
11098825	Aroclor-1260	3.3000	J	3.7000	J	UG/KG	041M52E201	2 / 5	2.40 - 14.00	3.5	3.7	N/A	11000	6900	C	N/A	NO	BSL
7440382	Arsenic (As)	0.3100	J	0.3100	J	MG/KG	041M52E301	1 / 5	0.18 - 0.86	0.31	0.31	N/A	15	9.2	C	N/A	NO	BSL
7440393	Barium (Ba)	2.2000	J	43.30	J	MG/KG	041M52E301	5 / 5	NAV	14.88	43.3	N/A	22000	34000	N	N/A	NO	BSL
56553	Benzo(a)anthracene	25.0000	J	100.0000	J	UG/KG	041M52E101	2 / 5	84.00 - 270.00	63.00	100	N/A	30000	19000	C	N/A	NO	BSL
50328	Benzo(a)pyrene	64.0000		64.0000		UG/KG	041M52E101	1 / 5	48.00 - 270.00	64.00	64	N/A	3000	1900	C	N/A	NO	BSL
205892	Benzo(b)fluoranthene	190.0000		190.0000		UG/KG	041M52E101	1 / 5	48.00 - 270.00	190.00	190	N/A	30000	19000	C	N/A	NO	BSL
191242	Benzo(g,h,i)perylene	45.0000	J	45.0000	J	UG/KG	041M52E101	1 / 5	48.00 - 270.00	45.00	45	N/A	8500000	15000000	N	N/A	NO	BSL
207089	Benzo(k)fluoranthene	61.0000		61.0000		UG/KG	041M52E101	1 / 5	48.00 - 270.00	61.00	61	N/A	300000	190000	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.6800	J	0.6800	J	MG/KG	041M52A101	1 / 5	0.07 - 0.42	0.68	0.68	N/A	630	980	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (B)	50.0000	J	360.00	J	UG/KG	041M52E301	5 / 5	NAV	192.00	360	N/A	1800000	980000	C	N/A	NO	BSL
7440702	Calcium (Ca)	526.0000		3670.00		MG/KG	041M52E301	5 / 5	NAV	1887.20	3670	N/A	N/A	N/A	N/A	N/A	NO	EN
86748	Carbazole	45.0000	J	45.0000	J	UG/KG	041M52E301	1 / 5	520.00 - 2700.00	45.00	45	N/A	1100000	690000	C	N/A	NO	BSL
7440473	Chromium (Cr)	1.2000		6.70		MG/KG	041M52D101	5 / 5	NAV	3.32	6.7	N/A	1500	2500	N	N/A	NO	BSL
218019	Chrysene	130.0000		130.0000		UG/KG	041M52E101	1 / 5	48.00 - 270.00	130.00	130	N/A	3000000	1900000	C	N/A	NO	BSL
7440484	Cobalt (Co)	0.2100	J	1.4000	J	MG/KG	041M52E101	3 / 5	0.22 - 0.84	0.62	1.4	N/A	19000	29000	N	N/A	NO	BSL
7440508	Copper (Cu)	0.8200	J	8.40	J	MG/KG	041M52A101	5 / 5	NAV	2.98	8.4	N/A	13000	20000	N	N/A	NO	BSL
319858	delta-BHC	0.8100	J	0.8100	J	UG/KG	041M52D101	1 / 5	0.12 - 0.69	0.81	0.81	N/A	12000	7500	C	N/A	NO	BSL
132649	Dibenzofuran	72.0000	J	72.0000	J	UG/KG	041M52E301	1 / 5	520.00 - 2700.00	72.00	72	N/A	1300000	2000000	N	N/A	NO	BSL
60571	Dieldrin	9.5000	J	9.5000	J	UG/KG	041M52A101	1 / 5	0.24 - 0.45	9.50	9.5	N/A	1400	860	C	N/A	NO	BSL
84742	Di-n-butylphthalate	49.0000	J	150.0000	J	UG/KG	041M52A101	3 / 5	480.00 - 840.00	89.00	150	N/A	32000000	49000000	N	N/A	NO	BSL
959988	Endosulfan I	0.3900	J	5.7000	J	UG/KG	041M52A101	2 / 5	0.13 - 0.22	3.05	5.7	N/A	1900000	2900000	N	N/A	NO	BSL
1031078	Endosulfan sulfate	1.2000	J	1.2000	J	UG/KG	041M52E301	1 / 5	0.26 - 1.40	1.20	1.2	N/A	1900000	2500000	N	N/A	NO	BSL
72208	Endrin	1.7000	J	2.4000	J	UG/KG	041M52E201	2 / 5	0.24 - 1.40	2.05	2.4	N/A	95000	150000	N	N/A	NO	BSL
206440	Fluoranthene	130.0000		140.0000		UG/KG	041M52E301	2 / 5	84.00 - 270.00	135.00	140	N/A	13000000	20000000	N	N/A	NO	BSL
86737	Fluorene	84.0000		84.0000		UG/KG	041M52E301	1 / 5	25.00 - 130.00	84.00	84	N/A	13000000	20000000	N	N/A	NO	BSL
58899	gamma-BHC (Lindane)	0.4300	J	0.4300	J	UG/KG	041M52E101	1 / 5	0.12 - 0.69	0.43	0.43	N/A	17000	11000	C	N/A	NO	BSL
5103742	gamma-Chlordane	0.8100	J	0.9100	J	UG/KG	041M52A101	1 / 5	0.12 - 0.22	0.91	0.91	N/A	17000	11000	C	N/A	NO	BSL
193355	Indeno(1,2,3-cd)pyrene	51.0000	J	51.0000	J	UG/KG	041M52E101	1 / 5	48.00 - 270.00	51.00	51	N/A	30000	19000	C	N/A	NO	BSL
7439896	Iron (Fe)	361.0000		2300.00		MG/KG	041M52A101	5 / 5	NAV	1156.60	2300	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	2.6000		17.70		MG/KG	041M52D101	5 / 5	NAV	7.36	17.7	N/A	400	400	OSWER	NO	BSL	
7439954	Magnesium (Mg)	110.0000	J	1280.00	J	MG/KG	041M52A101	5 / 5	NAV	613.00	1280	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	2.0000		15.80		MG/KG	041M52E301	5 / 5	NAV	9.08	15.8	N/A	15000	23000	N	N/A	NO	BSL
91203	Naphthalene	100.0000		100.0000		UG/KG	041M52E301	1 / 5	52.00 - 270.00	100.00	100	N/A	13000000	20000000	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.9900	J	5.2000	J	MG/KG	041M52E301	4 / 5	3.30 - 3.90	2.35	5.2	N/A	5300	9800	N	N/A	NO	BSL
85018	Phenanthrene	240.0000		240.0000		UG/KG	041M52E301	1 / 5	52.00 - 270.00	240.00	240	N/A	9500000	15000000	N	N/A	NO	BSL
7440097	Potassium (K)	22.2000	J	180.00	J	UG/KG	041M52E301	5 / 5	NAV	80.46	180	N/A	N/A	N/A	N/A	N/A	NO	EN
128000	Pyrene	62.0000		140.0000		UG/KG	041M52E101	2 / 5	84.00 - 270.00	111.00	140	N/A	9500000	15000000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.7300	J	10.2000	J	MG/KG	041M52E201	4 / 5	0.37 - 0.37	3.69	10.2	N/A	1600	2500	N	N/A	NO	BSL
7440235	Sodium (Na)	61.1000	J	169.0000	J	MG/KG	041M52E201	3 / 5	14.60 - 23.20	124.37	189	N/A	N/A	N/A	N/A	N/A	NO	EN
108883	Toluene	21.0000	J	21.0000	J	UG/KG	041M52A101	1 / 5	14.00 - 71.00	21.00	21	N/A	63000000	98000000	N	N/A	NO	BSL
7440622	Vanadium (V)	1.1000	J	6.60	J	MG/KG	041M52A101	5 / 5	NAV	4.10	6.6	N/A	2200	3400	N	N/A	NO	BSL
7440686	Zinc (Zn)	3.2000		25.5000		MG/KG	041M52E201	4 / 5	1.70 - 1.70	11.18	25.5	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes - Selection Reason:

Above Screening Levels (ASL)

Below Screening Levels (BSL)

Background Levels (BLG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-18-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland S2 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection	
7429905	Aluminum (Al)	116.00	J	2580.00		UG/L	041W52E301	2 / 2	NAV	1348.00	2580.00	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	4.90	J	6.60	J	UG/L	041W52A101	2 / 2	NAV	5.75	6.60	N/A	8300	18000	N	N/A	NO	BSL
7440702	Calcium (Ca)	808.00	J	10800.00		UG/L	041W52E301	2 / 2	NAV	5804.00	10800.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440508	Copper (Cu)	6.40	J	8.40	J	UG/L	041W52A101	1 / 2	NAV	6.40	6.40	N/A	4800	10000	N	N/A	NO	BSL
7439896	Iron (Fe)	1220.00		1220.00		UG/L	041W52E301	1 / 2	NAV	1220.00	1220.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	854.00	J	912.00	J	UG/L	041W52A101	2 / 2	NAV	883.00	912.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	8.20	J	10.50	J	UG/L	041W52A101	2 / 2	NAV	9.35	10.50	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	349.00	J	589.00	J	UG/L	041W52A101	2 / 2	NAV	469.00	589.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	2670.00	J	5260.00		UG/L	041W52A101	2 / 2	NAV	3965.00	5260.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	2.70	J	2.70	J	UG/L	041W52E301	1 / 2	NAV	2.70	2.70	N/A	830	1800	N	N/A	NO	BSL
7440666	Zinc (Zn)	12.40	J	12.40	J	UG/L	041W52E301	1 / 2	NAV	12.40	12.40	N/A	36000	76000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(8) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.18.6 Conclusions and Recommendations**

Wetland 52 was classified as a blue-coded wetland, because contaminants were mostly isolated and did not appear to be related to an IR site. Since no COPCs were identified for Wetland 52, no formal HHRA was conducted.

The type of contaminants detected (PAHs), indicate that the contamination found at Wetland 52 is likely related to storm water runoff from the NAS Fuel Farm, UST-18, and Forrest Sherman Field areas. Because the contamination cannot be tied to an IR site, Wetland 52 is referred to NAS Pensacola as documented in the September 18, 1996 Eco Meeting Minutes, and the September 19 and 20, 1996 Partnering Team Minutes and will not be assessed further in the Site 41 remedial investigation.

## **10.19 WETLAND 56**

### **10.19.1 Site Description**

Wetland 56 is south of Radford Boulevard near the Oak Grove Campground (Site 39). Parsons and Pruitt divided this wetland into two areas, Wetlands 56A and 56B (USEPA, 1991). Wetland 56A is described as palustrine emergent wetland in the back end of Sherman's Inlet. Wetland 56B is described as an estuarine emergent marsh along the littoral areas of Sherman's Inlet.

Surface water from Wetland 56 drains into Pensacola Bay via Sherman's Inlet. Wetland 56A receives storm water from Forrest Sherman Field and has an active National Pollution Discharge Elimination System (NPDES) permit at the storm water outlet, indicating it is a sampling station. Vegetation associated with Wetland 56A includes saw grass (*Cladium jamaicense*) and cattails (*Typha latifolia*). Black needlerush (*Juncus roemerianus*) is the dominant foliage in Wetland 56B. The northern edges of Wetland 56 are adjacent to the right-of-way for Radford Blvd., and are maintained by base landscaping contractors.

The IR site potentially affecting Wetland 56 is Site 39 (Oak Grove Campground). An interim removal action removed contaminated soil at the site in 1994, and the site was approved for no further action. Storm water runoff from Forrest Sherman Field may also contribute contaminants to Wetland 56.

### **10.19.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-19-1 denotes the Phase IIA Wetland 56 sampling location.

#### **Sediment**

Sixteen metals were detected in the single Wetland 56 sediment sample. No metals exceeded a sediment benchmark level at Wetland 56. Five pesticides were detected in the Wetland 56

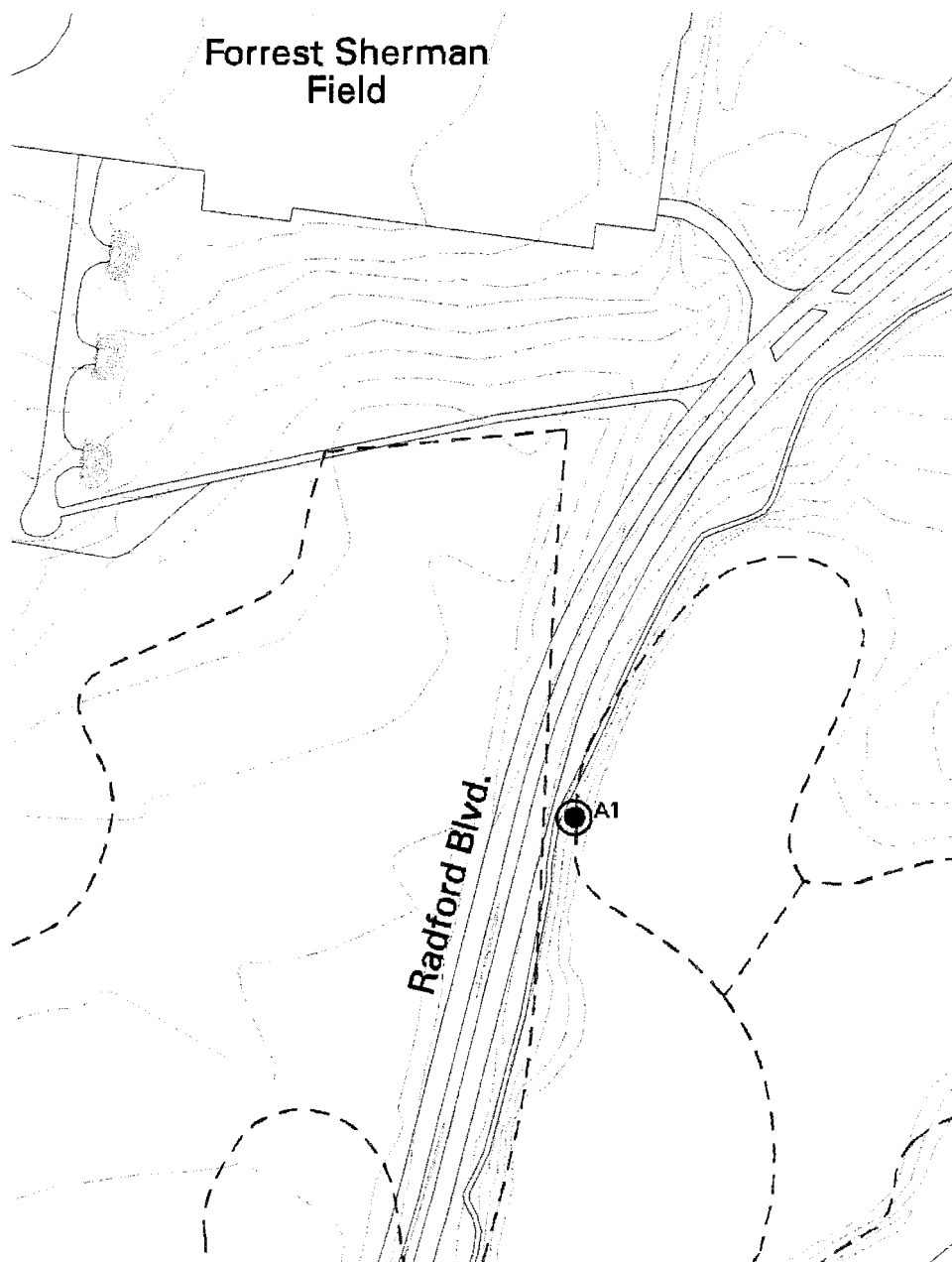
sediment sample, including 4,4'-DDT and its metabolites, endrin, and gamma-BHC. The 4,4'-DDD concentration (53 ppb) slightly exceeded its basewide level (50 ppb). 4,4'-DDT (2.8 ppb) and 4,4'-DDE (5.3 ppb) were both below their basewide concentrations of 20 ppb and 40 ppb respectively. Basewide levels are described in Section 6. Gamma-BHC (0.4 ppb) exceeded its sediment benchmark level (0.32 ppb). No PCBs were detected in the Wetland 56 sediment sample. Two SVOCs (pyrene and bis(2-ethylhexyl)phthalate) were detected below their sediment benchmark levels. No VOCs were detected in the Wetland 56 sediment sample.

Table 10-19-1 shows the Wetland 56 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-19-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-19-2. The HQs will be further discussed ecological risk section (Section 10.19.4).

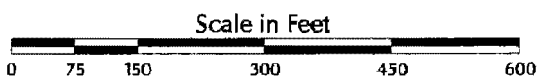
### **Surface Water**

Eight metals were detected in the single Wetland 56 surface water sample. Aluminum (596 ppb) was the only parameter to exceed its surface water metals concentration (87 ppb). No organics were detected in the Wetland 56 surface water sample.

Table 10-19-3 shows the Wetland 56 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-19-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with water quality criteria are presented in Table 10-19-4. The HQs will be further discussed ecological risk section (Section 10.19.4).



- Sediment Sample Location
- Surface Water Sample Collected
- - - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-19-1  
PHASE IIA WETLAND 56  
SAMPLING LOCATIONS**

Table 10-19-1  
 Phase IIA Detected Concentrations in Wetland 56 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	1/1	2560	2560
Arsenic (As)	1/1	0.33	0.33
Barium (Ba)	1/1	3.3	3.3
Calcium (Ca)	1/1	682	682
Chromium (Cr)	1/1	3.1	3.1
Cobalt (Co)	1/1	0.3	0.3
Copper (Cu)	1/1	3.1	3.1
Iron (Fe)	1/1	1210	1210
Lead (Pb)	1/1	9.4	9.4
Magnesium (Mg)	1/1	82.1	82.1
Manganese (Mn)	1/1	3.2	3.2
Nickel (Ni)	1/1	1.4	1.4
Potassium (K)	1/1	52	52
Selenium (Se)	1/1	2.4	2.4
Vanadium (V)	1/1	4	4
Zinc (Zn)	1/1	5.9	5.9
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	1/1	53	53
4,4'-DDE	1/1	5.3	5.3
4,4'-DDT	1/1	2.8	2.8
Endrin	1/1	0.39	0.39
gamma-BHC (Lindane)	1/1	0.4	0.4
<b>SVOCs (μg/kg)</b>			
Pyrene	1/1	36	36
bis(2-Ethylhexyl)phthalate (BEHP)	1/1	51	51

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-19-2  
Wetland 56  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M56A101</b>					
	4,4'-DDD (UG/KG)	53 D	1.22	43.44	b
	4,4'-DDE (UG/KG)	5.3 DJ	2.07	2.56	b
	4,4'-DDT (UG/KG)	2.8	1.19	2.35	b
	Arsenic (MG/KG)	0.33 J	7.24	0.05	a b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	51 J	182	0.28	b
	Chromium (MG/KG)	3.1	52.3	0.06	a b
	Copper (MG/KG)	3.1	18.7	0.17	a b
	Endrin (UG/KG)	0.39 J	3.3	0.12	a
	gamma-BHC (Lindane) (UG/KG)	0.4 J	0.32	1.25	b
	Lead (MG/KG)	9.4	30.2	0.31	a b
	Nickel (MG/KG)	1.4 J	15.9	0.09	a b
	Pyrene (UG/KG)	36 J	153	0.24	b
	Zinc (MG/KG)	5.9	124	0.05	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.  
Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.



Table 10-19-3  
 Detected Concentrations in Wetland 56 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	596	596
Barium (Ba)	1/1	4.4	4.4
Calcium (Ca)	1/1	12700	12700
Iron (Fe)	1/1	682	682
Magnesium (Mg)	1/1	1710	1710
Manganese (Mn)	1/1	11.2	11.2
Potassium (K)	1/1	676	676
Sodium (Na)	1/1	9730	9730

*Note:*  
 All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### 10.19.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 6. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking: thus many evaluations are qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-19-5 presents those contaminants present in sediment above SSVs and their calculated SSLs. Contaminants present in surface water above appropriate standards were previously presented in Table 10-19-4.

### Transport into the Wetland

#### *Surface Water/Sediment Pathway*

Sources — Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 56 through this pathway:

Table 10-19-4 (1)

## Wetland 56

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W56A101</b>	<b>Freshwater</b>					
Aluminum		UG/L	596.0	87.0	6.85057	a
Iron		UG/L	682.0	1,000.0	0.682	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-19-5  
 Calculated Sediment Screening Values for Wetland 56

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)		(ppb)	(ppb)	
4,4'-DDE	10.5 <sup>a</sup>	5.68E+04	5.96E+07	5.3	NO
4,4'-DDD	0.0064 <sup>a</sup>	1.27E+04	8.13E+03	53	NO
4,4'-DDT	0.001 <sup>a, b</sup>	3.34E+04	3,340	2.8	NO
Gamma BHC	0.08 <sup>a, b</sup>	1.36E+01	109.9	0.4	NO

**Notes:**

Kd for organics calculated using foc of 0.0126 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

- Storm water runoff and sediment entrainment from Site 39 and the southern portions of Forrest Sherman Field. Additionally, this wetland is directly connected to Wetland 52E and to Pensacola Bay, thus some back flushing of surface water during high tides and storm surge events can be expected.

The presence of sediment contaminants above SSVs (see Table 10-19-4) validates the sediment transport pathway, and by inference the surface water pathway.

#### *Groundwater Discharge Pathway*

Sources — Based on potentiometric analysis, the following sources can contribute contamination to Wetland 56 through this pathway:

- Discharge from Site 39. However, groundwater at this site has not been shown to be contaminated, thus the pathway is considered invalid.

## **Transport within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Pensacola Bay. However, tidal fluctuations can create a temporary landward movement. Therefore, both sediment and surface water contaminants can remain mobile.

### *Sediment Leaching to Surface Water Pathway*

Four pesticides exceeded their SSV (see Table 10-19-4). None of these pesticides exceeded the calculated SSL and corresponding detections of them were not noted in the surface water sample. Additionally, only aluminum was above its water quality criteria in surface water. Therefore, this pathway is considered invalid, and sediment contamination is not expected to partition to surface water.

## **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Pensacola Bay, therefore contamination will be mobile and not remain within the wetland.

### **10.19.4 Ecological Risk Assessment**

HQs for Wetland 56 sediment samples are presented in Table 10-19-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for 4,4'-DDD (43.44), 4,4'-DDE (2.56), and 4,4'-DDT (2.35), respectively. As noted in the nature and extent discussion, the concentration of 4,4'-DDD in the single Wetland 56 sediment sample was slightly above the basewide level. The concentrations for 4,4'-DDE and 4,4'-DDT were below basewide levels. The HQ was also greater than 1 for gamma-BHC (1.25). Phase IIA surface water results revealed a HQ greater than 1 for aluminum (6.85) at Wetland 56. HQs greater than 1 indicate the potential for excess risk.

Wetland 56 is a blue-coded wetland (E/A&H, 1995a). Since contaminants detected in the blue-coded wetlands were isolated, generally below benchmark or reference values, and did not appear to be related to IR sites, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.19.5 Human Health Risk Assessment**

##### **10.19.5.1 Samples Included**

###### **Sediment**

041M56A101

###### **Surface Water**

041W56A101

##### **10.19.5.2 Current and Future Land Use**

Wetland 56 is at the upstream end of Sherman's Inlet, a small estuarine inlet through which surface and storm water from the Wetland 52 complex drains into the Intercoastal Waterway of Pensacola Bay. The Oak Grove Campground abuts the wetland to the east, and Radford Boulevard is directly north. A jogging trail parallels Radford Blvd. just north of this wetland. The area may be used by Navy and civilian personnel who happen to be in the area for work related duties or children who find the area attractive. No routine grounds maintenance activities have been reported in this area, therefore, the maintenance worker scenario was not included in this risk assessment. There is no recreational or fishing use.

##### **10.19.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.19.5.4 Sediment COPCs**

As shown in Table 10-19-6, no sediment COPCs were identified.

#### **10.19.5.5 Surface Water COPCs**

As shown in Table 10-19-7, no surface water COPCs were identified.

#### **10.19.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 56.

#### **10.19.6 Conclusions and Recommendations**

Wetland 56 was classified as a blue-coded wetland because contaminants were mostly isolated, and did not appear to be related to an IR site. Since no COPCs were identified for Wetland 56, no formal HHRA was conducted.

Because the contamination cannot be tied to an IR site, Wetland 56 was referred to NAS Pensacola as documented in the September 18, 1996 Eco Meeting Minutes, and the September 19 and 20, 1996 Partnering Team Minutes. However based on comparison to the basewide DDT, DDD and DDE concentrations, no further action is proposed for this wetland.

TABLE 10-19-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 56 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	53.0000	D	53.0000	D	UG/KG	041M56A101	1 / 1	53.00	53	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	5.3000	DJ	5.3000	DJ	UG/KG	041M56A101	1 / 1	5.30	5.3	N/A	65000	41000	C	N/A	NO	BSL
50293	4,4'-DDT	2.8000		2.8000		UG/KG	041M56A101	1 / 1	2.80	2.8	N/A	65000	41000	C	N/A	NO	BSL
7429905	Aluminum (Al)	2560.0000		2560.0000		MG/KG	041M56A101	1 / 1	2560.00	2560	N/A	320000	490000	N	N/A	NO	BSL
7440382	Arsenic (As)	0.3300	J	0.3300	J	MG/KG	041M56A101	1 / 1	0.33	0.33	N/A	15	9.2	C	N/A	NO	BSL
7440383	Barium (Ba)	3.3000	J	3.3000	J	MG/KG	041M56A101	1 / 1	3.30	3.3	N/A	22000	34000	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	51.0000	J	51.0000	J	UG/KG	041M56A101	1 / 1	51.00	51	N/A	1600000	980000	C	N/A	NO	BSL
7440702	Calcium (Ca)	682.0000		682.0000		MG/KG	041M56A101	1 / 1	682.00	682	N/A	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	3.1000		3.1000		MG/KG	041M56A101	1 / 1	3.10	3.1	N/A	1600	2500	N	N/A	NO	BSL
7440484	Cobalt (Co)	0.3000	J	0.3000	J	MG/KG	041M56A101	1 / 1	0.30	0.3	N/A	19000	29000	N	N/A	NO	BSL
7440508	Copper (Cu)	3.1000		3.1000		MG/KG	041M56A101	1 / 1	3.10	3.1	N/A	13000	20000	N	N/A	NO	BSL
72208	Endrin	0.3900	J	0.3900	J	UG/KG	041M56A101	1 / 1	0.39	0.39	N/A	95000	150000	N	N/A	NO	BSL
56899	gamma-BHC (Lindane)	0.4000	J	0.4000	J	UG/KG	041M56A101	1 / 1	0.40	0.4	N/A	17000	11000	C	N/A	NO	BSL
7439896	Iron (Fe)	1210.0000		1210.0000		MG/KG	041M56A101	1 / 1	1210.00	1210	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	9.4000		9.4000		MG/KG	041M56A101	1 / 1	9.40	9.4	N/A	400	400		OSWER	NO	BSL
7439954	Magnesium (Mg)	82.1000	J	82.1000	J	MG/KG	041M56A101	1 / 1	82.10	82.1	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	3.2000		3.2000		MG/KG	041M56A101	1 / 1	3.20	3.2	N/A	15000	23000	N	N/A	NO	BSL
7440020	Nickel (Ni)	1.4000	J	1.4000	J	MG/KG	041M56A101	1 / 1	1.40	1.4	N/A	6300	9800	N	N/A	NO	BSL
7440097	Potassium (K)	52.0000	J	52.0000	J	MG/KG	041M56A101	1 / 1	52.00	52	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	36.0000	J	36.0000	J	UG/KG	041M56A101	1 / 1	36.00	36	N/A	9500000	15000000	N	N/A	NO	BSL
7782492	Selenium (Se)	2.4000	J	2.4000	J	MG/KG	041M56A101	1 / 1	2.40	2.4	N/A	1600	2500	N	N/A	NO	BSL
7440622	Vanadium (V)	4.0000		4.0000		MG/KG	041M56A101	1 / 1	4.00	4	N/A	2200	3400	N	N/A	NO	BSL
7440666	Zinc (Zn)	5.9000		5.9000		MG/KG	041M56A101	1 / 1	5.90	5.9	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes Selection Reason:

Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-19-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 68 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
7429905	Aluminum (Al)	596.00		596.00		UG/L	041W56A101	1 / 1	NAV	596.00	596.00	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	4.40	J	4.40	J	UG/L	041W56A101	1 / 1	NAV	4.40	4.40	N/A	8300	18000	N	N/A	NO	BSL
7440702	Calcium (Ca)	12700.00		12700.00		UG/L	041W56A101	1 / 1	NAV	12700.00	12700.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	682.00		682.00		UG/L	041W56A101	1 / 1	NAV	682.00	682.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	1710.00	J	1710.00	J	UG/L	041W56A101	1 / 1	NAV	1710.00	1710.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	11.20	J	11.20	J	UG/L	041W56A101	1 / 1	NAV	11.20	11.20	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	676.00	J	676.00	J	UG/L	041W56A101	1 / 1	NAV	676.00	676.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	9730.00		9730.00		UG/L	041W56A101	1 / 1	NAV	9730.00	9730.00	N/A	N/A	N/A	N/A	N/A	NO	EN

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Detection Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic



## **10.20 WETLAND 57**

### **10.20.1 Site Description**

Wetland 57 is north of the Oak Grove Campground (Site 39), and due south of Forrest Sherman Field. Parsons and Pruitt described this area as a palustrine forested emergent system, containing slash pine (*Pinus elliotti*) and sweet bay magnolia (*Magnolia virginiana*) (USEPA, 1991). This area serves as a minor drainage pathway for the surrounding area and may actually be considered a drainage ditch.

No IR sites are in the immediate vicinity of Wetland 57. The closest site is Site 39 (Oak Grove Campground Site), on the western side of the Oak Grove Campground. An IRA removed contaminated soil at this site in 1994, and the site was approved for no further action.

### **10.20.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-20-1 denotes the Phase IIA Wetland 57 sampling location.

#### **Sediment**

Eighteen metals were detected in the single Wetland 57 sediment sample. Mercury (0.14 ppm) exceeded its sediment benchmark level (0.13 ppm). Six pesticides were detected in Wetland 57 sediment, including 4,4'-DDT and its metabolites, aldrin, and beta/gamma-BHC. 4,4'-DDT and its metabolites exceeded their benchmark levels, but were below their basewide levels. The basewide levels are described in Section 6. Gamma-BHC (0.4 ppb) exceeded its sediment benchmark level (0.32 ppb). Aroclor-1260 was detected below its benchmark level. Three SVOCs, benzo(b)fluoranthene, fluoranthene, and pyrene, were detected below their benchmark levels. Acetone, a common laboratory contaminant, was also detected at Wetland 57.

Table 10-20-1 shows the Wetland 57 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-20-2, which presents only the parameters with benchmark levels, compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section (Section 10.20.4).

### **Surface Water**

Twelve metals were detected in the single Wetland 57 surface water sample. Aluminum (7,390 ppb), iron (7,360 ppb) and lead (16.9 ppb) exceeded surface water quality criteria. Methylene chloride, a common laboratory contaminant, was also detected below its surface water quality criteria.

Table 10-20-3 shows the Wetland 57 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-20-4, which presents only the parameters with quality criteria, compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. The HQs will be further discussed ecological risk section (Section 10.20.4).

### **10.20.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking, thus the evaluation is qualitative in nature. The method of evaluating leaching from sediment to surface water was presented in Section 9. Table 10-20-5 presents those contaminants present in sediment above SSVs and their calculated SSLs. Contaminants present in surface water above appropriate standards were presented in Table 10-20-4.

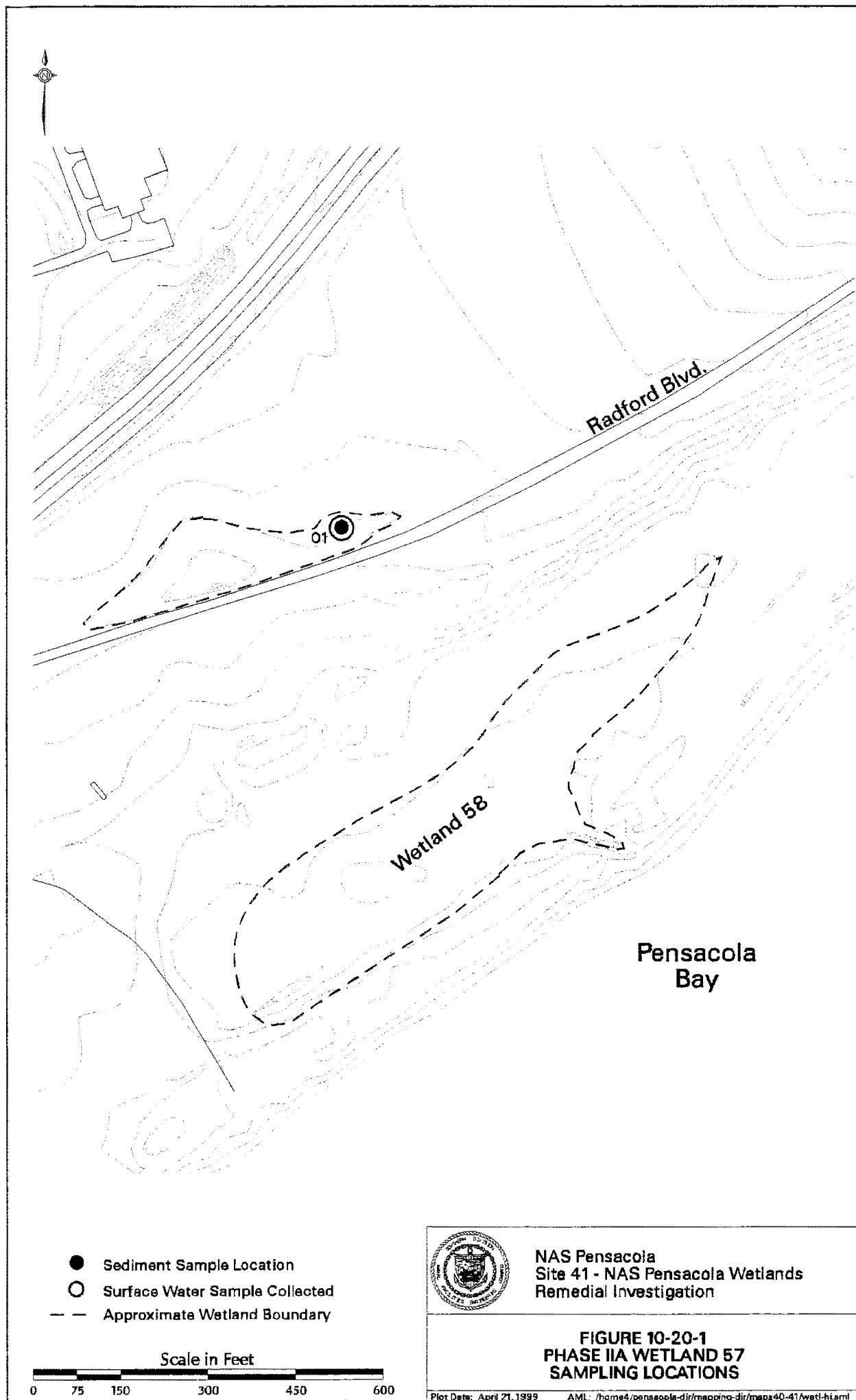


Table 10-20-1  
 Phase IIA Detected Concentrations in Wetland 57 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	1/1	5520	5520
Arsenic (As)	1/1	1.6	1.6
Barium (Ba)	1/1	11.3	11.3
Calcium (Ca)	1/1	2720	2720
Chromium (Cr)	1/1	4.8	4.8
Cobalt (Co)	1/1	0.45	0.45
Copper (Cu)	1/1	4.9	4.9
Iron (Fe)	1/1	3790	3790
Lead (Pb)	1/1	17.7	17.7
Magnesium (Mg)	1/1	214	214
Manganese (Mn)	1/1	15.8	15.8
Mercury (Hg)	1/1	0.14	0.14
Nickel (Ni)	1/1	2	2
Potassium (K)	1/1	117	117
Selenium (Se)	1/1	1.6	1.6
Sodium (Na)	1/1	48.8	48.8
Vanadium (V)	1/1	9.2	9.2
Zinc (Zn)	1/1	14.7	14.7
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	1/1	3.3	3.3
4,4'-DDE	1/1	7.2	7.2
4,4'-DDT	1/1	1.2	1.2
Aldrin	1/1	0.2	0.2
Aroclor-1260	1/1	3.7	3.7
beta-BHC	1/1	0.19	0.19
gamma-BHC (Lindane)	1/1	0.4	0.4

Table 10-20-1  
 Phase IIA Detected Concentrations in Wetland 57 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Benzo(b)fluoranthene	1/1	41	41
Fluoranthene	1/1	68	68
Pyrene	1/1	72	72
<b>VOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Acetone	1/1	49	49

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

## Transport within the Wetland

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that the wetland is self-enclosed, and that surface water and sediment movement would be influenced primarily by storm water influx.

### *Sediment Leaching to Surface Water Pathway*

Four pesticides and one inorganic exceeded their benchmark levels (see Table 10-20-5), but only one — mercury — exceeded its SSL. Mercury was not detected in the corresponding surface water, thus the potential for leaching is low even though the pathway is considered valid. Three inorganics were present in surface water above standards, but they are likely attributable to the surface water/groundwater migration pathway. Because one parameter exceeded its SSL, the sediment leaching pathway is valid, although the lack of this parameter in surface water suggests a low potential for partitioning.

Table 10-20-2  
Wetland 57  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M570101</b>					
	4,4'-DDD (UG/KG)	3.3 J	1.22	2.70	b
	4,4'-DDE (UG/KG)	7.2 J	2.07	3.48	b
	4,4'-DDT (UG/KG)	1.2 J	1.19	1.01	b
	Aroclor-1260 (UG/KG)	3.7	21.6	0.17	b
	Arsenic (MG/KG)	1.6	7.24	0.22	a b
	Chromium (MG/KG)	4.8 J	52.3	0.09	a b
	Copper (MG/KG)	4.9	18.7	0.26	a b
	Fluoranthene (UG/KG)	68 J	113	0.60	b
	gamma-BHC (Lindane) (UG/KG)	0.4 J	0.32	1.25	b
	Lead (MG/KG)	17.7	30.2	0.59	a b
	Mercury (MG/KG)	0.14 J	0.13	1.08	a b
	Nickel (MG/KG)	2 J	15.9	0.13	a b
	Pyrene (UG/KG)	72	153	0.47	b
	Zinc (MG/KG)	14.7	124	0.12	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-20-3  
 Phase IIA Detected Concentrations in Wetland 57 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	7390	7390
Barium (Ba)	1/1	25.3	25.3
Calcium (Ca)	1/1	19400	19400
Copper (Cu)	1/1	7.2	7.2
Iron (Fe)	1/1	7360	7360
Lead (Pb)	1/1	16.9	16.9
Magnesium (Mg)	1/1	1570	1570
Manganese (Mn)	1/1	134	134
Potassium (K)	1/1	1040	1040
Sodium (Na)	1/1	6470	6470
Vanadium (V)	1/1	12.2	12.2
Zinc (Zn)	1/1	17.5	17.5
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Methylene chloride	1/1	150	150

*Note:*  
 All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### Transport from the Wetland

Due to the self-enclosed nature of the wetland, surface water and sediment movement will be confined to the wetland and contamination can be expected to remain within the wetland.

### Transport into the Wetland

#### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources would contribute contamination to Wetland 57 through this pathway:

- Local runoff from Radford Boulevard paralleling the southern boundary of the base.

Table 10-20-4 (1)

## Wetland 57

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W570101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	7,390.0	87.0	84.94253	a
	Copper	UG/L	7.2	7.8	0.92308	a b
	Iron	UG/L	7,360.0	1,000.0	7.36	a b
	Lead	UG/L	16.9	1.71	9.88304	a b
	Zinc	UG/L	17.5	70.2	0.24929	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.



Table 10-20-5  
 Calculated Sediment Screening Values for Wetland 5

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppb)		(ppm)	(ppm)	
Mercury	0.012 <sup>a, b</sup>	5.2E+01	0.0624	0.14	YES
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4'-DDE	10.5 <sup>a</sup>	1.16E+05	1.22E+08	7.2	NO
4,4'-DDD	0.0064 <sup>a</sup>	2.6E+04	1.69E+04	3.3	NO
4,4'-DDT	0.001 <sup>a, b</sup>	6.85E+04	6.85E+03	1.2	NO
Gamma BHC	0.08 <sup>a, b</sup>	27.88	2.24E+02	0.4	NO

**Notes:**

Kd for organics calculated using foc of 0.026 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric and landform analysis there are no known sources that would contribute contamination to Wetland 57 through this pathway. Therefore this pathway is considered invalid.

### 10.20.4 Ecological Risk Assessment

HQs for Wetland 57 sediment samples are presented in Table 10-20-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed a HQ above 1 for mercury (1.08). Sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for 4,4'-DDD (2.7), 4,4'-DDE (3.48), and 4,4'-DDT (1.01), respectively. However, as noted in the nature and extent discussion, the concentrations of 4,4'-DDT and its metabolites were below basewide levels. The HQ was also greater than 1 for gamma-BHC (1.25).

Phase IIA surface water results revealed HQs greater than 1 for aluminum (84.94), iron (7.36), and lead (9.88) at Wetland 57. HQs greater than 1 indicate a potential for excess risk.

Wetland 57 is a blue-coded wetland (E/A&H, 1995a). Since contaminants detected in the blue-coded wetlands were isolated, generally below benchmark, basewide, or reference values, and did not appear to be related to IR sites, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.20.5 Human Health Risk Assessment**

##### **10.20.5.1 Samples Included**

###### **Sediment**

041M570101

###### **Surface Water**

041W570101

##### **10.20.5.2 Current and Future Land Use**

Wetland 57 is north of the Oak Grove Campground, and serves as a drainage conveyance for the wooded buffer between the campground and Radford Blvd., which passes the campground to the north. Though a jogging trail passes by adjacent to this wetland, it lies in a thickly vegetated area which would preclude any person from easily trespassing into the area. No routine grounds maintenance activities appear to be performed here, and there is no recreational or fishing use.

##### **10.20.5.3 Fish COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.20.5.4 Sediment COPCs Identified**

As shown in Table 10-20-6, no sediment COPCs were identified.

#### **10.20.5.5 Surface Water COPCs Identified**

As shown in Table 10-20-7, the following chemical was identified as a COPC:

- Lead

#### **10.20.5.6 Risk Characterization**

##### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland 57. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 57 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the Lead Model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 57.

The assumption was made that this child would incidentally ingest 0.05 liters of surface water during each visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 57 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of 16.9  $\mu\text{g/L}$ , the annual alternate source exposure was estimated to be 0.12  $\mu\text{g}$  lead/day. Table 10-20-8 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

TABLE 10-20-6

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 57 Sediment

CAS Number	Chemical	(1)		(1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2)		(3)	(4)		(5)		COPC Flag	Rationale for Contaminant Detection or Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Residential Soil RBC	Potential ARAR/TBC Source				
72548	4,4'-DDD	3.3000	J	3.3000	J	UG/KG	041M570101	1 / 1	NAV	3.3	3.3	N/A	92000	2700	C	N/A	NO	BSL	
72559	4,4'-DDE	7.2000	J	7.2000	J	UG/KG	041M570101	1 / 1	NAV	7.2	7.2	N/A	65000	1900	C	N/A	NO	BSL	
50293	4,4'-DDT	1.2000	J	1.2000	J	UG/KG	041M570101	1 / 1	NAV	1.2	1.2	N/A	65000	1900	C	N/A	NO	BSL	
67641	Acetone	49.0000		49.0000		UG/KG	041M570101	1 / 1	NAV	49	49	N/A	32000000	780000	N	N/A	NO	BSL	
309002	Aldrin	0.2000	J	0.2000	J	UG/KG	041M570101	1 / 1	NAV	0.2	0.2	N/A	1300	38	C	N/A	NO	BSL	
7429905	Aluminum (Al)	5520.0000		5520.0000		MG/KG	041M570101	1 / 1	NAV	5520	5520	N/A	320000	7800	N	N/A	NO	BSL	
11096825	Aroclor-1260	3.7000		3.7000		UG/KG	041M570101	1 / 1	NAV	3.7	3.7	N/A	11000	320	C	N/A	NO	BSL	
7440382	Arsenic (As)	1.6000		1.6000		MG/KG	041M570101	1 / 1	NAV	1.6	1.6	N/A	15	0.43	C	N/A	NO	BSL	
7440393	Barium (Ba)	11.3000	J	11.3000	J	MG/KG	041M570101	1 / 1	NAV	11.3	11.3	N/A	22000	550	N	N/A	NO	BSL	
205992	Benzo(b)fluoranthene	41.0000	J	41.0000	J	UG/KG	041M570101	1 / 1	NAV	41	41	N/A	30000	880	C	N/A	NO	BSL	
319857	beta-BHC	0.1900	J	0.1900	J	UG/KG	041M570101	1 / 1	NAV	0.19	0.19	N/A	12000	350	C	N/A	NO	BSL	
7440702	Calcium (Ca)	2720.0000		2720.0000		MG/KG	041M570101	1 / 1	NAV	2720	2720	N/A	N/A	N/A	N/A	NO	EN		
7440473	Chromium (Cr)	4.8000	J	4.8000	J	MG/KG	041M570101	1 / 1	NAV	4.8	4.8	N/A	1600	23	N	N/A	NO	BSL	
7440484	Cobalt (Co)	0.4500	J	0.4500	J	MG/KG	041M570101	1 / 1	NAV	0.45	0.45	N/A	19000	470	N	N/A	NO	BSL	
7440508	Copper (Cu)	4.9000		4.9000		MG/KG	041M570101	1 / 1	NAV	4.9	4.9	N/A	13000	310	N	N/A	NO	BSL	
206440	Fluoranthene	68.0000	J	68.0000	J	UG/KG	041M570101	1 / 1	NAV	68	68	N/A	13000000	310000	N	N/A	NO	BSL	
58899	gamma-BHC (Lindane)	0.4000	J	0.4000	J	UG/KG	041M570101	1 / 1	NAV	0.4	0.4	N/A	17000	490	C	N/A	NO	BSL	
7439896	Iron (Fe)	3790.0000		3790.0000		MG/KG	041M570101	1 / 1	NAV	3790	3790	N/A	N/A	N/A	N/A	NO	EN		
7439921	Lead (Pb)	17.7000		17.7000		MG/KG	041M570101	1 / 1	NAV	17.7	17.7	N/A	400	400	OSWER	NO	BSL		
7439954	Magnesium (Mg)	214.0000	J	214.0000	J	MG/KG	041M570101	1 / 1	NAV	214	214	N/A	N/A	N/A	N/A	NO	EN		
7439965	Manganese (Mn)	15.8000		15.8000		MG/KG	041M570101	1 / 1	NAV	15.8	15.8	N/A	15000	1100	N	N/A	NO	BSL	
7439976	Mercury (Hg)	0.1400	J	0.1400	J	MG/KG	041M570101	1 / 1	NAV	0.14	0.14	N/A	95	2.3	N	N/A	NO	BSL	
7440020	Nickel (Ni)	2.0000	J	2.0000	J	MG/KG	041M570101	1 / 1	NAV	2	2	N/A	6300	160	N	N/A	NO	BSL	
7440097	Potassium (K)	117.0000	J	117.0000	J	MG/KG	041M570101	1 / 1	NAV	117	117	N/A	N/A	N/A	N/A	NO	EN		
129000	Pyrene	72.0000		72.0000		UG/KG	041M570101	1 / 1	NAV	72	72	N/A	9500000	230000	N	N/A	NO	BSL	
7782492	Selenium (Se)	1.6000		1.6000		MG/KG	041M570101	1 / 1	NAV	1.6	1.6	N/A	1600	39	N	N/A	NO	BSL	
7440235	Sodium (Na)	48.8000	J	48.8000	J	MG/KG	041M570101	1 / 1	NAV	48.8	48.8	N/A	N/A	N/A	N/A	NO	EN		
7440622	Vanadium (V)	9.2000		9.2000		MG/KG	041M570101	1 / 1	NAV	9.2	9.2	N/A	2200	3400	N	N/A	NO	BSL	
7440566	Zinc (Zn)	14.7000		14.7000		MG/KG	041M570101	1 / 1	NAV	14.7	14.7	N/A	95000	150000	N	N/A	NO	BSL	

(1) Minimum/maximum detected concentration  
(2) Maximum concentration used as screening value.  
(3) Background values were not developed for this media.  
(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.  
(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(6) Rationale Codes	Selection Reason:	Above Screening Levels (ASL)
	Deletion Reason:	Below Screening Levels (BSL)
		Background Levels (BKG)
		No Toxicity Information (NTX)
		Essential Nutrient (EN)

**Definitions:**

N/A = Not Applicable  
 NAV = Not Available  
 COPC = Chemical of Potential Concern  
 ARAR/BC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
 OSWER = Office of Solid Waste and Emergency Response  
 J = Estimated Value  
 C = Carcinogenic  
 N Noncarcinogenic

TABLE 10-20-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 57 Surface Water

CAS Number	Chemical	(1)		(1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2)		Background Value	(3)		(4)		Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Adolescent Site Trespasser PRG		Tap Water RBC						
7429905	Aluminum (Al)	7390.00	0	7390.00	0	UG/L	041W570101	1 / 1	NAV	7390.00	7390.00	N/A	120000	3700	N	N/A	NO	BSL		
7440393	Barium (Ba)	25.30	J	25.30	J	UG/L	041W570101	1 / 1	NAV	25.30	25.30	N/A	8300	260	N	N/A	NO	BSL		
7440702	Calcium (Ca)	19400.00	0	19400.00	0	UG/L	041W570101	1 / 1	NAV	19400.00	19400.00	N/A	N/A	N/A	N	N/A	NO	EN		
7440508	Copper (Cu)	7.20	J	7.20	J	UG/L	041W570101	1 / 1	NAV	7.20	7.20	N/A	4800	150	N	N/A	NO	BSL		
7439896	Iron (Fe)	7360.00	0	7360.00	0	UG/L	041W570101	1 / 1	NAV	7360.00	7360.00	N/A	N/A	N/A	N	N/A	NO	EN		
7439921	Lead (Pb)	16.90	0	16.90	0	UG/L	041W570101	1 / 1	NAV	16.90	16.90	N/A	15	15		TTAL	YES	ASL		
7439954	Magnesium (Mg)	1570.00	J	1570.00	J	UG/L	041W570101	1 / 1	NAV	1570.00	1570.00	N/A	N/A	N/A	N	N/A	NO	EN		
7439965	Manganese (Mn)	134.00	0	134.00	0	UG/L	041W570101	1 / 1	NAV	134.00	134.00	N/A	2400	73	N	N/A	NO	BSL		
75092	Methylene chloride	150.00	D	150.00	D	UG/L	041W570101	1 / 1	NAV	150.00	150.00	N/A	1000	4.1	C	N/A	NO	BSL		
7440097	Potassium (K)	1040.00	J	1040.00	J	UG/L	041W570101	1 / 1	NAV	1040.00	1040.00	N/A	N/A	N/A	N	N/A	NO	EN		
7440235	Sodium (Na)	6470.00	0	6470.00	0	UG/L	041W570101	1 / 1	NAV	6470.00	6470.00	N/A	N/A	N/A	N	N/A	NO	EN		
7440622	Vanadium (V)	12.20	J	12.20	J	UG/L	041W570101	1 / 1	NAV	12.20	12.20	N/A	830	26	N	N/A	NO	BSL		
7440666	Zinc (Zn)	17.50	J	17.50	J	UG/L	041W570101	1 / 1	NAV	17.50	17.50	N/A	36000	1100	N	N/A	NO	BSL		

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

**Table 10-20-8**  
**Lead Model (Version 0.99d) Inputs and Results**  
 NAS Pensacola, Wetland 57  
 Pensacola, Florida

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 57 surface water

6-7: 0.12  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil+Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	2.7	9.53	4.89	3.36	1.13	0.06	0.09

Figure 10-20-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 2.7  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 0.25%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, surface water lead concentrations at Wetland 57 would not require specific action under the hypothetical exposure scenario.

#### **10.20.5.7 Remedial Goal Options**

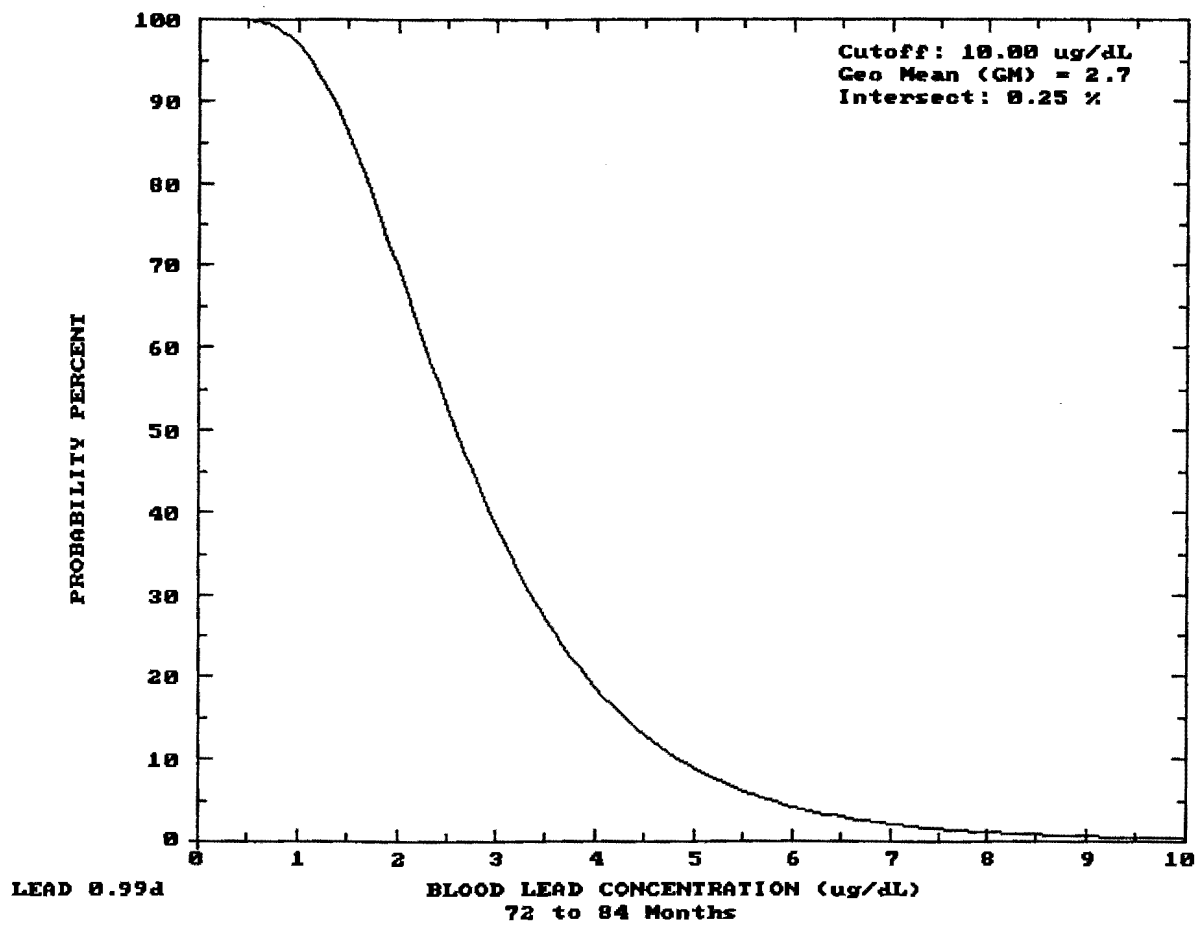
No COCs were identified for Wetland 57, and as a result, no RGOs were calculated.

#### **10.20.6 Conclusions and Recommendations**

Wetland 57 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III.

The HHRA identified no fish tissue or sediment COPCs. Lead was identified as a surface water COPC. Under USEPA guidelines, surface water lead concentrations at Wetland 57 would not require specific action under the hypothetical exposure scenario. Therefore, no COCs were identified for Wetland 57 and no RGOs were calculated. Because no ecological or human health risks are present at Wetland 57, no further action is recommended for this wetland.

Figure 10-20-2 Probability Plots for Blood Lead Levels Wetland 57





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## **10.21 WETLAND 58**

### **10.21.1 Site Description**

Wetland 58 is near the shoreline of the intercostal waterway, southwest of Lighthouse Point and east of the Oak Grove Campground (Site 39). Parsons and Pruitt (USEPA, 1991) described this area as a palustrine shrub-scrub system with the dominant vegetation made up of titi (*Cyrilla racemiflora*) and buttonbush (*Cephalanthus occidentalis*).

Wetland 58 is adjacent to an isolated location of the Intercoastal Waterway at NAS Pensacola. It appears as a heavily vegetated interdunal swale, upgradient from the shoreline, and is seasonally saturated during the rainy season. A seaward breach allows surface water to run off into the Intercoastal Waterway. This wetland is a fresh water wetland and is not regularly tidally influenced. It does, however, appear to wash out during severe storms.

No IR sites exist in the immediate vicinity of Wetland 58.

### **10.21.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-21-1 denotes the Phase IIA Wetland 58 sampling location.

#### **Sediment**

Fifteen metals were detected in the single Wetland 58 sediment sample. No metals exceeded the sediment benchmark levels at Wetland 58. No pesticides were detected in the Wetland 58 sediment sample. The PCB Aroclor-1260 was detected below its sediment benchmark level. Thirteen SVOCs, mostly high-and low-molecular weight PAHs, were detected in Wetland 58 sediment samples. Six SVOCs exceeded benchmark criteria including 2-methylnaphthalene (110 ppb), acenaphthene (110 ppb), anthracene (84 ppb), fluorene (120 ppb), naphthalene (220 ppb), and phenanthrene (250 ppb). The VOC acetone, a common laboratory

contaminant, was detected at Wetland 58. Table 10-21-1 shows the Wetland 58 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-21-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only detected parameters with benchmark levels are presented in Table 10-21-2. The HQs will be further discussed ecological risk section (Section 10.21.4).

### **Surface Water**

Eleven metals were detected in the single Wetland 58 surface water sample. Aluminum (1,090 ppb), iron (4,070 ppb), and lead (7.4 ppb) exceeded their surface water quality criteria at Wetland 58. No organics were detected in Wetland 58 surface water samples.

Table 10-21-3 shows the Wetland 58 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-21-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the parameters with quality criteria are presented in Table 10-21-4. The HQs will be further discussed ecological risk section (Section 10.21.4).

### **10.21.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus many evaluations are qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-21-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-21-4.

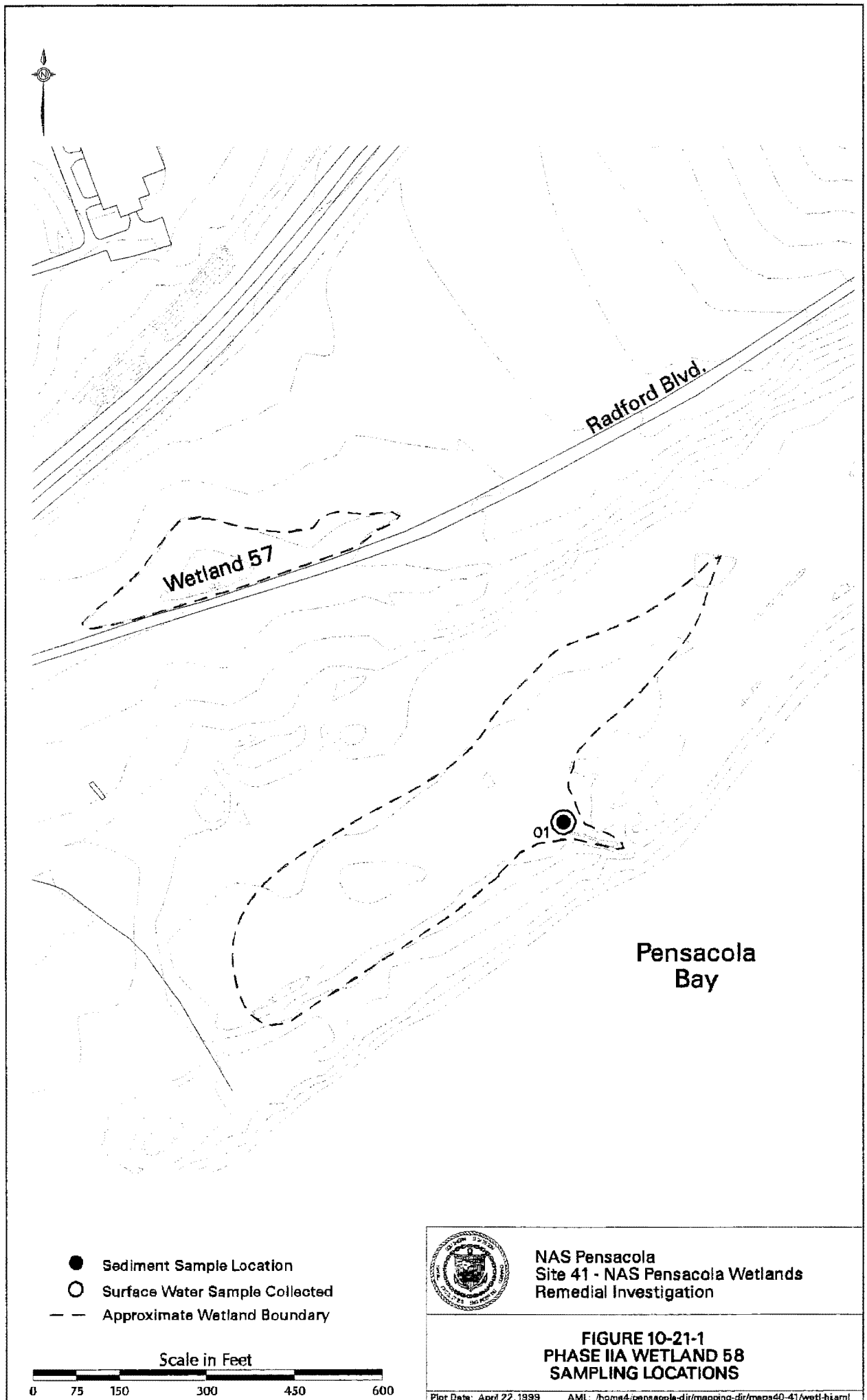


Table 10-21-1  
 Phase IIA Detected Concentrations in Wetland 58 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	1/1	1360	1360
Arsenic (As)	1/1	0.27	0.27
Barium (Ba)	1/1	1.2	1.2
Calcium (Ca)	1/1	230	230
Chromium (Cr)	1/1	1.2	1.2
Copper (Cu)	1/1	1.8	1.8
Iron (Fe)	1/1	548	548
Lead (Pb)	1/1	7.8	7.8
Magnesium (Mg)	1/1	70	70
Manganese (Mn)	1/1	1.2	1.2
Nickel (Ni)	1/1	1.2	1.2
Potassium (K)	1/1	41.2	41.2
Selenium (Se)	1/1	0.41	0.41
Vanadium (V)	1/1	2.5	2.5
Zinc (Zn)	1/1	2.3	2.3
<b>PCBs (<math>\mu\text{g/kg}</math>)</b>			
Aroclor-1260	1/1	0.66	0.66
<b>SVOCs (<math>\mu\text{g/kg}</math>)</b>			
2-Methylnaphthalene	1/1	110	110
Acenaphthene	1/1	110	110
Anthracene	1/1	84	84
Butylbenzylphthalate	1/1	25	25
Carbazole	1/1	40	40
Di-n-butylphthalate	1/1	42	42
Dibenzofuran	1/1	88	88
Fluoranthene	1/1	110	110
Fluorene	1/1	120	120

Table 10-21-1  
 Phase IIA Detected Concentrations in Wetland 58 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g}/\text{kg}</math>) (Continued)</b>			
Naphthalene	1/1	220	220
Phenanthrene	1/1	250	250
Pyrene	1/1	70	70
bis(2-Ethylhexyl)phthalate (BEHP)	1/1	34	34
<b>VOCs (<math>\mu\text{g}/\text{kg}</math>)</b>			
Acetone	1/1	520	520

**Notes:**

All results are in micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 58 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 39 and 4, and from roadways and paved areas on the southeast side of the N-S runway at Forrest Sherman Field.

The presence of sediment contaminants above benchmark levels (see Table 10-21-5) validates the sediment transport pathway, and by inference the surface water pathway. Additionally, copper, lead, and iron were present in surface water above standards, further validating the pathway.

Table 10-21-2  
Wetland 58  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M580101</b>					
	2-Methylnaphthalene (UG/KG)	110	20.2	5.45	b
	Acenaphthene (UG/KG)	110	6.71	16.39	b
	Anthracene (UG/KG)	84	46.9	1.79	b
	Aroclor-1260 (UG/KG)	0.66 J	21.6	0.03	b
	Arsenic (MG/KG)	0.27 J	7.24	0.04	a b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	34 J	182	0.19	b
	Chromium (MG/KG)	1.2	52.3	0.02	a b
	Copper (MG/KG)	1.8	18.7	0.10	a b
	Fluoranthene (UG/KG)	110	113	0.97	b
	Fluorene (UG/KG)	120	21.2	5.66	b
	Lead (MG/KG)	7.8	30.2	0.26	a b
	Naphthalene (UG/KG)	220	34.6	6.36	b
	Nickel (MG/KG)	1.2 J	15.9	0.08	a b
	Phenanthrene (UG/KG)	250	86.7	2.88	b
	Pyrene (UG/KG)	70	153	0.46	b
	Zinc (MG/KG)	2.3	124	0.02	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.  
Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

Table 10-21-3  
 Phase IIA Detected Concentrations in Wetland 58 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	1090	1090
Arsenic (As)	1/1	3.1	3.1
Barium (Ba)	1/1	3.4	3.4
Calcium (Ca)	1/1	9230	9230
Copper (Cu)	1/1	5.2	5.2
Iron (Fe)	1/1	4070	4070
Lead (Pb)	1/1	7.4	7.4
Magnesium (Mg)	1/1	4110	4110
Potassium (K)	1/1	1420	1420
Sodium (Na)	1/1	11400	11400
Vanadium (V)	1/1	10.6	10.6

*Note:*

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 58 through this pathway:

- Discharge from Site 4. Groundwater from this site, however, has not been found to be contaminated, thus the pathway is considered invalid.

### Transport within the Wetland

#### Surface Water/Sediment Migration Pathway

There does exist a small drainage feature on the southeast side of the wetland. This feature is likely active during very high water table events or storm surge recession. The likely migratory pathway for surface water and sediment is towards the Pensacola Bay. Therefore, both sediment and surface water contamination can be expected to remain mobile.



Table 10-21-4 (1)

## Wetland 58

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W580101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	1,090.0	87.0	12.52874	a
	Arsenic	UG/L	3.1	50.0	0.062	b
	Copper	UG/L	5.2	7.8	0.66667	a b
	Iron	UG/L	4,070.0	1,000.0	4.07	a b
	Lead	UG/L	7.4	1.71	4.32749	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-21-5  
 Calculated Sediment Screening Values for Wetland 58

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)		(ppb)	(ppb)	
2-methylnaphthalene	NA	3.66E+01	NA	110	NO
Anthracene	110,000 <sup>b</sup>	1.44E+02	1.59E+09	84	NO
Acenaphthene	17 <sup>a</sup>	3.82E+01	6.51E+04	110	NO
Fluorene	14,000 <sup>b</sup>	6.74E+01	9.45E+07	120	NO
Naphthalene	62 <sup>a</sup>	9.78	6.14E+04	220	NO
Phenanthrene	0.031 <sup>b</sup>	1.47E+02	4.56E+02	250	NO

**Notes:**

Kd for organics calculated using foc of 0.0127 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### *Sediment Leaching to Surface Water Pathway*

Six organics — all semivolatiles — exceeded their respective benchmark levels, but none exceeded their calculated SSL. None of the parameters that exceeded surface water criteria were present above benchmark levels in sediment (which are lower than a calculated SSL) indicating their provenance to be surface water migration. Therefore, this pathway is considered invalid and contaminants in sediment can be expected to remain within that media.

### **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into the Bay system during periods of high water table or during storm surge recession.

#### **10.21.4 Ecological Risk Assessment**

HQs for Wetland 58 sediment samples are presented in Table 10-21-2. Phase IIA sediment results compared to the appropriate sediment benchmark levels revealed HQs above 1 for the SVOCs 2-methylnaphthalene (5.45), acenaphthene (16.39), anthracene (1.79), fluorene (5.66), naphthalene (6.36), and phenanthrene (2.88). Phase IIA surface water results revealed HQs above 1 for aluminum (12.52), iron (4.07), and lead (6.32). HQs greater than 1 indicate the potential for excess risk.

Wetland 58 is a blue-coded wetland (E/A&H, 1995a). Since contaminants detected in the blue-coded wetlands were isolated, generally below screening or reference values, and did not appear to be related to IR sites, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.21.5 Human Health Risk Assessment**

##### **10.21.5.1 Samples Included**

###### **Sediment**

041M580101

###### **Surface Water**

041W580101

##### **10.21.5.2 Current and Future Land Use**

Wetland 58 is on an isolate stretch of beach along the Intercoastal Waterway of Pensacola Bay. It lies approximately 0.5 miles east of Oak Grove Campground, and 0.5 miles west of a group of beach cabins rented by the base Morale, Welfare, and Recreation (MWR) department. The area is open to the public, so the adolescent trespasser scenario is valid. Hikers might venture into the area. Wetland 58 is not in an area which would be frequented by maintenance workers. A

dune restoration area lies to the south of Wetland 58, indicating that this area is likely going to remain preserved in its natural state.

#### **10.21.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.21.5.4 Sediment COPCs**

As shown in Table 10-21-6, no sediment COPCs were identified.

#### **10.21.5.5 Surface Water COPCs**

As shown in Table 10-21-7, no surface water COPCs were identified.

#### **10.21.5.6 Risk Summary**

No COPCs were identified from Wetland 58. As a result, no formal human health risk assessment was conducted for Wetland 58.

#### **10.21.6 Conclusions and Recommendations**

Wetland 58 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III. Since no COPCs were identified for Wetland 58, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland 58, no further action is recommended for this wetland.

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 58 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
83329	Acenaphthene	110.0000		110.0000		UG/KG	041M580101	1 / 1	NAV	110.00	110	N/A	19000000	470000	N	N/A	BSL
67641	Acetone	520.0000		520.0000		UG/KG	041M580101	1 / 1	NAV	520.00	520	N/A	32000000	780000	N	N/A	BSL
7429905	Aluminum (Al)	1360.0000		1360.0000		MG/KG	041M580101	1 / 1	NAV	1360.00	1360	N/A	320000	7800	N	N/A	BSL
120127	Anthracene	84.0000		84.0000		UG/KG	041M580101	1 / 1	NAV	84.00	84	N/A	95000000	2300000	N	N/A	BSL
11098825	Aroclor-1260	0.6600	J	0.6600	J	UG/KG	041M580101	1 / 1	NAV	0.66	0.66	N/A	11000	320	C	N/A	BSL
7440382	Arsenic (As)	0.2700	J	0.2700	J	MG/KG	041M580101	1 / 1	NAV	0.27	0.27	N/A	15	0.43	C	N/A	BSL
7440393	Barium (Ba)	1.2000	J	1.2000	J	MG/KG	041M580101	1 / 1	NAV	1.20	1.2	N/A	22000	550	N	N/A	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	34.0000	J	34.0000	J	UG/KG	041M580101	1 / 1	NAV	34.00	34	N/A	1600000	46000	C	N/A	BSL
85687	Butylbenzylphthalate	25.0000	J	25.0000	J	UG/KG	041M580101	1 / 1	NAV	25.00	25	N/A	63000000	1600000	N	N/A	BSL
7440702	Calcium (Ca)	230.0000	J	230.0000	J	MG/KG	041M580101	1 / 1	NAV	230.00	230	N/A	N/A	N/A	N/A	N/A	EN
86748	Carbazole	40.0000	J	40.0000	J	UG/KG	041M580101	1 / 1	NAV	40.00	40	N/A	1100000	32000	C	N/A	BSL
7440473	Chromium (Cr)	1.2000		1.2000		MG/KG	041M580101	1 / 1	NAV	1.20	1.2	N/A	1600	23	N	N/A	BSL
7440508	Copper (Cu)	1.8000		1.8000		MG/KG	041M580101	1 / 1	NAV	1.80	1.8	N/A	13000	310	N	N/A	BSL
132649	Dibenzofuran	88.0000	J	88.0000	J	UG/KG	041M580101	1 / 1	NAV	88.00	88	N/A	1300000	31000	N	N/A	BSL
84742	Di-n-butylphthalate	42.0000	J	42.0000	J	UG/KG	041M580101	1 / 1	NAV	42.00	42	N/A	32000000	780000	N	N/A	BSL
206440	Fluoranthene	110.0000		110.0000		UG/KG	041M580101	1 / 1	NAV	110.00	110	N/A	13000000	310000	N	N/A	BSL
86737	Fluorene	120.0000		120.0000		UG/KG	041M580101	1 / 1	NAV	120.00	120	N/A	13000000	310000	N	N/A	BSL
7439896	Iron (Fe)	548.0000		548.0000		MG/KG	041M580101	1 / 1	NAV	548.00	548	N/A	N/A	N/A	N/A	N/A	EN
7439821	Lead (Pb)	7.8000		7.8000		MG/KG	041M580101	1 / 1	NAV	7.80	7.8	N/A	400	400	OSWER	N/A	BSL
7439954	Magnesium (Mg)	70.0000	J	70.0000	J	MG/KG	041M580101	1 / 1	NAV	70.00	70	N/A	N/A	N/A	N/A	N/A	EN
7439965	Manganese (Mn)	1.2000		1.2000		MG/KG	041M580101	1 / 1	NAV	1.20	1.2	N/A	15000	1100	N	N/A	BSL
91203	Naphthalene	220.0000		220.0000		UG/KG	041M580101	1 / 1	NAV	220.00	220	N/A	13000000	310000	N	N/A	BSL
7440020	Nickel (Ni)	1.2000	J	1.2000	J	MG/KG	041M580101	1 / 1	NAV	1.20	1.2	N/A	6300	160	N	N/A	BSL
85018	Phenanthrene	250.0000		250.0000		UG/KG	041M580101	1 / 1	NAV	250.00	250	N/A	9500000	230000	N	N/A	BSL
7440097	Potassium (K)	41.2000	J	41.2000	J	MG/KG	041M580101	1 / 1	NAV	41.20	41.2	N/A	N/A	N/A	N/A	N/A	EN
129000	Pyrene	70.0000		70.0000		UG/KG	041M580101	1 / 1	NAV	70.00	70	N/A	9500000	230000	N	N/A	BSL
7782492	Selenium (Se)	0.4100	J	0.4100	J	MG/KG	041M580101	1 / 1	NAV	0.41	0.41	N/A	1600	39	N	N/A	BSL
7440622	Vanadium (V)	2.5000	J	2.5000	J	MG/KG	041M580101	1 / 1	NAV	2.50	2.5	N/A	2200	55	N	N/A	BSL
7440666	Zinc (Zn)	2.3000		2.3000		MG/KG	041M580101	1 / 1	NAV	2.30	2.3	N/A	95000	2300	N	N/A	BSL

TABLE 10-21-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 58 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Traspasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant/ Delection or Selection
7429905	Aluminum (Al)	1090.00		1090.00		UG/L	041W580101	1 / 1	NAV	1090.00	1090	N/A	120000	3700	N	N/A	BSL
7440382	Arsenic (As)	3.10	J	3.10	J	UG/L	041W580101	1 / 1	NAV	3.10	3.1	N/A	5.6	0.045	C	N/A	BSL
7440393	Barium (Ba)	3.40	J	3.40	J	UG/L	041W580101	1 / 1	NAV	3.40	3.4	N/A	8300	260	N	N/A	BSL
7440702	Calcium (Ca)	9230.00		9230.00		UG/L	041W580101	1 / 1	NAV	9230.00	9230	N/A	N/A	N/A	N	N/A	EN
7440508	Copper (Cu)	5.20	J	5.20	J	UG/L	041W580101	1 / 1	NAV	5.20	5.2	N/A	4800	150	N	N/A	BSL
7439896	Iron (Fe)	4070.00		4070.00		UG/L	041W580101	1 / 1	NAV	4070.00	4070	N/A	N/A	N/A	N	N/A	EN
7439921	Lead (Pb)	7.40		7.40		UG/L	041W580101	1 / 1	NAV	7.40	7.4	N/A	15	15		TTAL	BSL
7439954	Magnesium (Mg)	4110.00	J	4110.00	J	UG/L	041W580101	1 / 1	NAV	4110.00	4110	N/A	N/A	N/A	N	N/A	EN
7440097	Potassium (K)	1420.00	J	1420.00	J	UG/L	041W580101	1 / 1	NAV	1420.00	1420	N/A	N/A	N/A	N	N/A	EN
7440235	Sodium (Na)	11400.00		11400.00		UG/L	041W580101	1 / 1	NAV	11400.00	11400	N/A	N/A	N/A	N	N/A	EN
7440622	Vanadium (V)	10.60	J	10.60	J	UG/L	041W580101	1 / 1	NAV	10.60	10.6	N/A	830	26	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Delection Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

## **10.22 WETLAND 63B**

### **10.22.1 Site Description**

Wetland 63B is on the northeast side of former Chevalier Field (now the NATTC), along the shoreline of Pensacola Bay. Wetland 63B is bordered by Site 14 to the south, buildings and development to the west, and Pensacola Bay to the east. Parsons and Pruitt described this area as an estuarine emergent system (USEPA, 1991). The upland area surrounding Wetland 63B is vegetated with plants typically found in a disturbed area. The saturated area contains common reed (*Phragmites australis*) and sawgrass (*Cladium jamaicense*). Wetland 63B serves as a storm water drainage pathway for the southeastern portion of the former Chevalier Field area. The wetland is tidally influenced, has open standing water year round, and discharges to Pensacola Bay through a drainage channel about three feet wide.

IR sites potentially affecting Wetland 63B include Sites 13 and 14. Site 13 (Magazine Point Rubble Disposal Site) is north of Wetland 63B and extends along the eastern waterfront of Magazine Point and the northeast portion of former Chevalier Field (now NATTC). Site 14 (Dredge Spoil Fill) is adjacent to Wetland 63B to the south and was created between 1975 and 1977 as a dredge spoil deposition area (NEESA, 1983).

### **10.22.2 Nature and Extent**

#### **Sediment**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-22-1 denotes the Phase IIA Wetland 63B sampling locations.

Nineteen metals were detected in Wetland 63B sediment samples. No metals exceeded sediment benchmark levels at Wetland 63B. Three pesticides were detected in Wetland 63B sediment samples, including 4,4'-DDD/DDE and endosulfan sulfate. The DDT metabolites were below basewide levels (50 ppb and 40 ppb respectively). The basewide levels are presented in

Section 6. Endosulfan sulfate was also below its benchmark level. The PCB Aroclor-1260 was detected in Wetland 63B sediment samples below its benchmark level. Fourteen SVOCs, mostly high and low molecular weight PAHs, were detected in Wetland 63B sediment samples. Four SVOCs exceeded sediment benchmark criteria, including the PAHs 2-methylnaphthalene (24 ppb), acenaphthene (39 ppb), fluorene (47 ppb), and phenanthrene (120 ppb). All of the exceedances are at sample location 63B04. No VOCs were detected in Wetland 63B sediment samples.

Table 10-22-1 shows the Wetland 63B Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-22-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-22-2. The HQs will be further discussed in the ecological risk section (Section 10.22.4).

### **Surface Water**

Eleven metals were detected in the Wetland 63B surface water samples. Iron (1,560 ppb) exceeded surface water quality criteria (300 ppb) at sample location 63B02. The only organic detected in Wetland 63B surface water samples was the phthalate ester, di-n-butylphthalate (22 ppb) which exceeded its surface water quality criteria (3.4 ppb), also at location 63B02.

Table 10-22-3 shows the Wetland 63B Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-22-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-22-4. The HQs will be further discussed in the ecological risk section (Section 10.22.4).



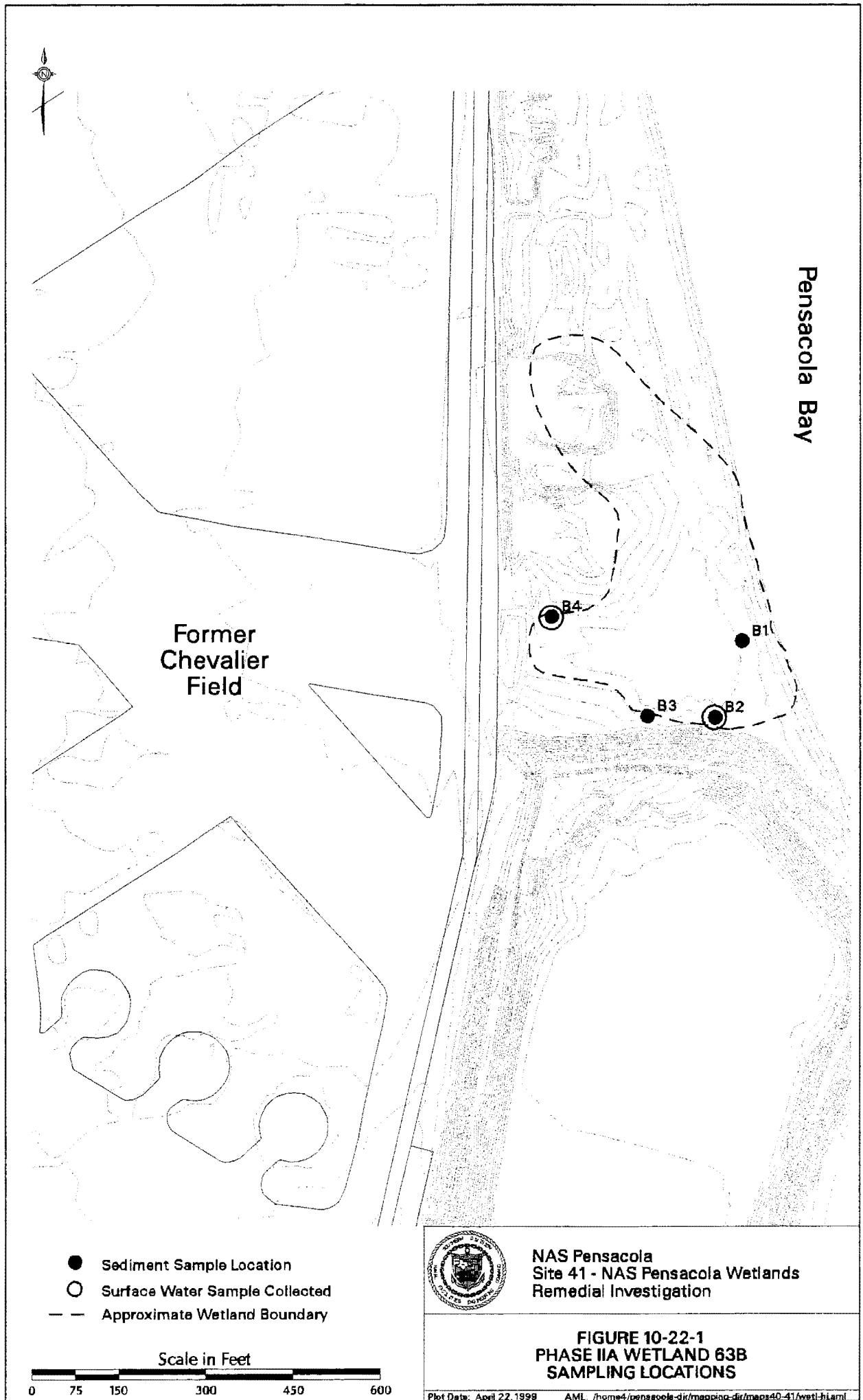


Table 10-22-1  
 Phase IIA Detected Concentrations in Wetland 63B Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	4/4	101 - 1960	650
Antimony (Sb)	1/4	0.25	0.25
Arsenic (As)	2/4	0.24 - 0.43	0.34
Barium (Ba)	4/4	0.71 - 4	1.7
Beryllium (Be)	1/4	0.1	0.1
Calcium (Ca)	4/4	191 - 3230	1315.5
Chromium (Cr)	4/4	0.34 - 5.2	1.94
Cobalt (Co)	2/4	0.2 - 0.42	0.31
Copper (Cu)	4/4	0.35 - 4.4	1.69
Iron (Fe)	4/4	112 - 1290	564.75
Lead (Pb)	4/4	0.95 - 13	4.413
Magnesium (Mg)	4/4	33.6 - 410	151.485
Manganese (Mn)	4/4	0.88 - 7.1	3.25
Nickel (Ni)	1/4	0.88	0.88
Potassium (K)	4/4	10.3 - 121	47.4
Selenium (Se)	1/4	0.4	0.4
Sodium (Na)	4/4	28.4 - 129	70.05
Vanadium (V)	4/4	0.35 - 3.9	1.5
Zinc (Zn)	4/4	0.79 - 13	4.5
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	2/4	0.23 - 0.34	0.285
4,4'-DDE	3/4	0.27 - 0.37	0.3333
Aroclor-1260	4/4	1.2 - 6.3	3
Endosulfan sulfate	1/4	0.98	0.98
<b>SVOCs (μg/kg)</b>			
2-Methylnaphthalene	1/4	24	24
Acenaphthene	1/4	39	39

Table 10-22-1  
 Phase IIA Detected Concentrations in Wetland 63B Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
SVOCs ( $\mu\text{g/kg}$ ) (Continued)			
Anthracene	1/4	44	44
Benzo(a)pyrene	1/4	39	39
Benzo(b)fluoranthene	1/4	56	56
Butylbenzylphthalate	1/4	29	29
Di-n-butylphthalate	1/4	27	27
Dibenzofuran	1/4	34	34
Fluoranthene	3/4	41 - 86	62
Fluorene	1/4	47	47
Naphthalene	1/4	23	23
Phenanthrene	1/4	120	120
Pyrene	3/4	41 - 65	49
bis(2-Ethylhexyl)phthalate (BEHP)	3/4	33 - 97	57.33

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

### 10.22.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking: thus the evaluation is qualitative in nature. The method of evaluating the leaching from sediment to surface water was presented in Section 9. Table 10-22-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria are presented in Table 10-22-4.

Table 10-22-2  
Wetland 63B  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M63B201</b>					
1	4,4'-DDD (UG/KG)	0.24 J	1.22	0.28	b
2	4,4'-DDE (UG/KG)	0.27 J	2.07	0.13	b
3	Antimony (MG/KG)	0.25 J	12	0.02	a
4	Aroclor-1260 (UG/KG)	1.5 J	21.6	0.07	b
5	Arsenic (MG/KG)	0.24 J	7.24	0.03	a b
6	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	42 J	182	0.23	c
7	Chromium (MG/KG)	1.3	52.3	0.02	a b
8	Copper (MG/KG)	1.1 J	18.7	0.06	a b
9	Fluoranthene (UG/KG)	88	113	0.76	b
10	Lead (MG/KG)	1.8	30.2	0.08	a b
11	Pyrene (UG/KG)	66	163	0.42	b
12	Zinc (MG/KG)	2.8	124	0.02	a b

**041M63B201**

4,4'-DDD (UG/KG)	0.24 J	1.22	0.28	b
4,4'-DDE (UG/KG)	0.27 J	2.07	0.13	b
Antimony (MG/KG)	0.25 J	12	0.02	a
Aroclor-1260 (UG/KG)	1.5 J	21.6	0.07	b
Arsenic (MG/KG)	0.24 J	7.24	0.03	a b
bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	42 J	182	0.23	c
Chromium (MG/KG)	1.3	52.3	0.02	a b
Copper (MG/KG)	1.1 J	18.7	0.06	a b
Fluoranthene (UG/KG)	88	113	0.76	b
Lead (MG/KG)	1.8	30.2	0.08	a b
Pyrene (UG/KG)	66	163	0.42	b
Zinc (MG/KG)	2.8	124	0.02	a b

<b>041M63B401</b>					
1	2-Methylnaphthalene (UG/KG)	24 J	20.2	1.19	b
2	4,4'-DDD (UG/KG)	0.23 J	1.22	0.19	b

**041M63B401**

2-Methylnaphthalene (UG/KG)	24 J	20.2	1.19	b
4,4'-DDD (UG/KG)	0.23 J	1.22	0.19	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.
- Basewide levels (detailed in Section 6) for DDT and its metabolites
- Basewide level for 4,4'-DDE is 40 ppb.
- Basewide level for 4,4'-DDD is 50 ppb.
- Basewide level for 4,4'-DDT is 20 ppb.

Table 10-22-2  
Wetland 63B  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	4,4'-DDE (UG/KG)	0.37 J	2.07	0.18	b
	Acenaphthene (UG/KG)	39	6.71	5.81	b
	Anthracene (UG/KG)	44	46.9	0.94	b
	Aroclor-1260 (UG/KG)	3	21.6	0.14	b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	33 J	182	0.18	b
	Chromium (MG/KG)	0.91	52.3	0.02	a b
	Copper (MG/KG)	0.9 J	18.7	0.05	a b
	Fluoranthene (UG/KG)	59	113	0.52	b
	Fluorene (UG/KG)	47	21.2	2.22	b
	Lead (MG/KG)	1.9	30.2	0.06	a b
	Naphthalene (UG/KG)	23 J	34.6	0.66	b
	Phenanthrene (UG/KG)	120	86.7	1.38	b
	Pyrene (UG/KG)	41 J	153	0.27	b
	Zinc (MG/KG)	1.6	124	0.01	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.  
Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

**Table 10-22-3**  
**Phase IIA Detected Concentrations in Wetland 63B Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/2	157 - 1300	728.5
Arsenic (As)	1/2	3.1	3.1
Barium (Ba)	1/2	44.7 - 53	48.85
Calcium (Ca)	2/2	37800 - 39000	38400
Iron (Fe)	2/2	206 - 1560	883
Lead (Pb)	1/2	5.3	5.3
Magnesium (Mg)	2/2	10100 - 10600	10350
Manganese (Mn)	2/2	21.4 - 40.1	30.75
Sodium (Na)	2/2	64400 - 71700	68050
Vanadium (V)	1/2	3.5	3.5
Zinc (Zn)	2/2	4.8 - 13.7	9.25
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
Di-n-butylphthalate	1/2	22	22

*Note:*

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 63B through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 13 and 14, and the eastern portions of Chevalier Field. The proximity of the wetland to Pensacola Bay indicates that there is a direct connection to the Bay during storm surge events.

The presence of sediment contaminants above benchmark levels (see Table 10-22-5) validates the sediment transport pathway, and by inference the surface water pathway. Additionally, the presence of one organic and one inorganic present in surface water above standards further validates the pathway.

Table 10-22-1 (1)

## Wetland 63B

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W63B401	Saltwater					
	Aluminum	UG/L	157.0	1,500.0	0.10467	b
	Iron	UG/L	206.0	300.0	0.68667	b
	Zinc	UG/L	4.8	86.0	0.05581	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-22-5  
 Calculated Sediment Screening Values for Wetland 63B

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics	(ppb)			(ppb)	
2 Methylanthalene	NA	6.00e+01	NA	24	NO
Acenaphthene	9.7 <sup>a</sup>	6.24e+01	6.07e+04	39	NO
Fluorene	14,000 <sup>b</sup>	1.10e+02	1.55e+08	47	NO
Phenanthrene	0.031 <sup>b</sup>	2.40e+02	2.31e+03	120	NO

**Notes:**

Kd for organics calculated using foc of 0.008 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class II Water Quality Criteria (1996).

### Groundwater Discharge Pathway

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 63B through this pathway:

- Discharge from Sites 13 and 14. However, groundwater from these sites has not been shown to be contaminated, thus the pathway is considered invalid.

### Transport within the Wetland

#### Surface Water/Sediment Migration Pathway

The configuration of the wetland, along with landform analysis, indicates that the wetland is self-enclosed, and that surface water and sediment movement is influenced primarily by storm water influx. A direct connection to Pensacola Bay during storm events, however, would allow surface water and sediment to move out of the wetland and towards Pensacola Bay. Under



normal conditions, both sediment and surface water contaminants can be expected to be constrained within the wetland.

*Sediment Leaching to Surface Water Pathway:*

Four SVOCs exceeded their sediment benchmark levels (see Table 10-22-5), but none of these exceeded the calculated SSL and corresponding detections of these SVOCs were not seen in the surface water samples. Iron and di-n-butylphthalate were the only parameters above standards in surface water, and they are likely attributable to the surface water/groundwater discharge pathway. Given the absence of parameters above SSLs, this pathway is considered invalid.

**Transport from the Wetland**

Surface water and sediment movement, under normal conditions, is expected to be contained to the wetland. However, storm events may allow a temporary connection to Pensacola Bay and allow contaminants to move out of the wetland.

**10.22.4 Ecological Risk Assessment**

HQs for Wetland 63B sediment samples are presented in Table 10-22-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for the SVOCS 2-methylnaphthalene (1.19), acenaphthene (5.81), fluorene (2.22), and phenanthrene (1.38), all at sample location 63B04. Phase IIA surface water results revealed an HQ greater than 1 for iron (5.20), and di-n-butylphthalate (6.47), both at sample location 63B02. HQs greater than 1 indicate the potential for excess risk.

Wetland 63B is a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded

wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.22.5 Human Health Risk Assessment**

##### **10.22.5.1 Samples Included**

###### **Sediment**

041M63B101, 041M63B201, 041M63B301, 041M3B401

###### **Surface Water**

041W63B201, 041W63B401

##### **10.22.5.2 Current and Future Land Use**

Wetland 63B is on the northeast side of the NATTC. When the NATTC was constructed in 1996, a boardwalk and gazebo were built on the north side of the wetland for use by NATTC students. Trespasser scenarios are therefore valid for this wetland.

##### **10.22.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

##### **10.22.5.4 Sediment COPCs**

As shown in Table 10-22-6, no sediment COPCs were identified.

##### **10.22.5.5 Surface Water COPCs**

As shown in Table 10-22-7, no surface water COPCs were identified.

TABLE 10-22-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 63b Sediment

CAS Number	Chemical	(1)	(1)	(1)	(1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2)	(3)	(4)	(5)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection	
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Residential Soil RBC				
91576	2-Methylnaphthalene	24.0000	J	24.0000	J	UG/KG	041M63B401	1 / 4	42.00 - 71.00	24.00	24.00	N/A	6300000	310000	N	N/A	NO	BSL
72548	4,4'-DDD	0.2300	J	0.3400	J	UG/KG	041M63B101	2 / 4	0.21 - 0.36	0.29	0.34	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	0.2700	J	0.3700	J	UG/KG	041M63B101	3 / 4	0.21 - 0.21	0.33	0.37	N/A	65000	1900	C	N/A	NO	BSL
83328	Acenaphthene	39.0000		39.0000		UG/KG	041M63B401	1 / 4	21.00 - 34.00	39.00	39.00	N/A	19000000	470000	N	N/A	NO	BSL
7429805	Aluminum (Al)	101.0000	J	1960.00	J	MG/KG	041M63B101	4 / 4	NAV	650.00	1960.00	N/A	320000	7800	N	N/A	NO	BSL
120127	Anthracene	44.0000		44.0000		UG/KG	041M63B401	1 / 4	42.00 - 71.00	44.00	44.00	N/A	95000000	2300000	N	N/A	NO	BSL
7440360	Antimony (Sb)	0.2500	J	0.2500	J	MG/KG	041M63B201	1 / 4	0.13 - 0.77	0.25	0.25	N/A	130	3.1	N	N/A	NO	BSL
11096825	Aroclor-1260	1.2000	J	6.30	J	UG/KG	041M63B401	4 / 4	NAV	3.00	6.30	N/A	11000	320	C	N/A	NO	BSL
7440382	Arsenic (As)	0.2400	J	0.4300	J	MG/KG	041M63B101	2 / 4	0.13 - 0.13	0.34	0.43	N/A	15	0.43	C	N/A	NO	BSL
7440393	Barium (Ba)	0.7100	J	4.00	J	MG/KG	041M63B101	4 / 4	NAV	1.70	4.00	N/A	22000	550	N	N/A	NO	BSL
50328	Benzo(a)pyrene	38.0000	J	39.0000	J	UG/KG	041M63B101	1 / 4	42.00 - 46.00	39.00	39.00	N/A	3000	88	C	N/A	NO	BSL
205992	Benzo(b)fluoranthene	56.0000	J	56.0000	J	UG/KG	041M63B101	1 / 4	42.00 - 46.00	56.00	56.00	N/A	30000	880	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.1000	J	0.1000	J	MG/KG	041M63B101	1 / 4	0.06 - 0.08	0.10	0.10	N/A	630	16	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	33.0000	J	97.0000	J	UG/KG	041M63B401	3 / 4	420.00 - 420.00	57.33	97.00	N/A	1600000	45000	C	N/A	NO	BSL
85687	Butylbenzylphthalate	29.0000	J	29.0000	J	UG/KG	041M63B401	1 / 4	420.00 - 710.00	29.00	29.00	N/A	63000000	1600000	N	N/A	NO	BSL
7440702	Calcium (Ca)	161.0000	J	3230.00	J	MG/KG	041M63B301	4 / 4	NAV	1315.50	3230.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	0.3400	J	5.20	J	MG/KG	041M63B101	4 / 4	NAV	1.94	5.20	N/A	1600	23	N	N/A	NO	BSL
7440484	Cobalt (Co)	0.2000	J	0.4200	J	MG/KG	041M63B201	2 / 4	0.13 - 0.13	0.31	0.42	N/A	18000	470	N	N/A	NO	BSL
7440508	Copper (Cu)	0.3500	J	4.40	J	MG/KG	041M63B101	4 / 4	NAV	1.69	4.40	N/A	13000	310	N	N/A	NO	BSL
132649	Dibenzofuran	34.0000	J	34.0000	J	UG/KG	041M63B401	1 / 4	420.00 - 710.00	34.00	34.00	N/A	1300000	31000	N	N/A	NO	BSL
84742	Di-n-butylphthalate	27.0000	J	27.0000	J	UG/KG	041M63B401	1 / 4	420.00 - 710.00	27.00	27.00	N/A	32000000	780000	N	N/A	NO	BSL
1031078	Endosulfan sulfate	0.9800	J	0.9800	J	UG/KG	041M63B201	1 / 4	0.21 - 0.36	0.98	0.98	N/A	1900000	47000	N	N/A	NO	BSL
206440	Fluoranthene	41.0000	J	86.0000	J	UG/KG	041M63B201	3 / 4	42.00 - 42.00	62.00	86.00	N/A	13000000	310000	N	N/A	NO	BSL
86737	Fluorene	47.0000		47.0000		UG/KG	041M63B401	1 / 4	21.00 - 34.00	47.00	47.00	N/A	13000000	310000	N	N/A	NO	BSL
7439896	Iron (Fe)	112.0000		1290.00		MG/KG	041M63B301	4 / 4	NAV	564.75	1290.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	0.9500		13.00		MG/KG	041M63B401	4 / 4	NAV	4.41	13.00	N/A	400	400	OSWER	N/A	NO	BSL
7439954	Magnesium (Mg)	33.6000	J	410.00	J	MG/KG	041M63B401	4 / 4	NAV	151.48	410.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	0.8800	J	7.10	J	MG/KG	041M63B401	4 / 4	NAV	3.25	7.10	N/A	15000	1100	N	N/A	NO	BSL
91203	Naphthalene	23.0000	J	23.0000	J	UG/KG	041M63B401	1 / 4	42.00 - 71.00	23.00	23.00	N/A	13000000	310000	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.8800	J	0.8800	J	MG/KG	041M63B101	1 / 4	0.57 - 0.68	0.88	0.88	N/A	6300	160	N	N/A	NO	BSL
85018	Phenanthrene	120.0000		120.0000		UG/KG	041M63B401	1 / 4	42.00 - 71.00	120.00	120.00	N/A	9500000	230000	N	N/A	NO	BSL
7440097	Potassium (K)	10.3000	J	121.00	J	MG/KG	041M63B401	4 / 4	NAV	47.40	121.00	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	41.0000	J	65.0000	J	UG/KG	041M63B101	3 / 4	42.00 - 42.00	49.00	65.00	N/A	9500000	230000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.4000		0.4000		MG/KG	041M63B401	1 / 4	0.25 - 0.30	0.40	0.40	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	26.4000	J	129.00	J	MG/KG	041M63B101	4 / 4	NAV	70.05	129.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	0.3500	J	3.90	J	MG/KG	041M63B101	4 / 4	NAV	1.50	3.90	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	0.7900	J	13.00	J	MG/KG	041M63B101	4 / 4	NAV	4.50	13.00	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1988).

(6) Rationale Codes      Selection Reason:  
    Deletion Reason:  
    Above Screening Levels (ASL)  
    Below Screening Levels (BSL)  
    Background Levels (BKG)  
    No Toxicity Information (NTX)  
    Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

**TABLE 10-22-7**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 83B Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection	
7429905	Aluminum (Al)	157	J	1300		UG/L	041W63B201	2 / 2	NAV	729	1300	N/A	120000	3700	N	N/A	NO	BSL
7440382	Arsenic (As)	3.1	J	3.1	J	UG/L	041W63B201	1 / 2	NAV	3.1	3.1	N/A	5.6	0.045	C	N/A	NO	BSL
7440393	Barium (Ba)	44.7	J	53.0	J	UG/L	041W63B201	2 / 2	NAV	48.9	53.0	N/A	8300	260	N	N/A	NO	BSL
7440702	Calcium (Ca)	37800		39000		UG/L	041W63B201	2 / 2	NAV	38400	39000	N/A	N/A	N/A	N/A	N/A	NO	EN
84742	Di-n-butylphthalate	22		22		UG/L	041W63B201	1 / 2	NAV	22	22	N/A	480	370	N	N/A	NO	BSL
7439896	Iron (Fe)	206		1560		UG/L	041W63B201	2 / 2	NAV	883	1560	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	5.3		5.3		UG/L	041W63B201	1 / 2	NAV	5.3	5.3	N/A	15	15		TTAL	NO	BSL
7439954	Magnesium (Mg)	10100		10600		UG/L	041W63B201	2 / 2	NAV	10350	10600	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	21.4		40.1		UG/L	041W63B201	2 / 2	NAV	30.8	40.1	N/A	2400	73	N	N/A	NO	BSL
7440097	Potassium (K)	7720		7900		UG/L	041W63B401	2 / 2	NAV	7810	7900	N/A	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	64400		71700		UG/L	041W63B201	2 / 2	NAV	68050	71700	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	3.5		3.5		UG/L	041W63B201	1 / 2	NAV	3.5	3.5	N/A	830	26	N	N/A	NO	BSL
7440666	Zinc (Zn)	4.8	J	13.7	J	UG/L	041W63B201	2 / 2	NAV	9.3	13.7	N/A	36000	1100	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment technique action level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.22.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8. As a result, no formal human health risk assessment was conducted for Wetland 63B.

#### **10.22.6 Conclusions and Recommendations**

Wetland 63B is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III. Since no COPCs were identified for Wetland 63B, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland 63B, no further action is recommended for this wetland.

## **10.23 WETLAND 72**

### **10.23.1 Site Description**

Wetland 72 is a drainage pathway that drains storm and surface water from the northwest side of Forrest Sherman Field and from the northern end of Wetland W-1 via a storm sewer that connects to Wetland 72 from the south. Surface water passing through Wetland 72 eventually drains into Bayou Grande via Wetland 39. Parsons and Pruitt described this area as a palustrine forested system surrounded by pines, oaks, and black titi (*Cliftonia monophylla*) (USEPA, 1991). Wetland 72 is roughly 3.2 acres in size. Some maintenance occurs at this location, as beaver dams constructed in the wetland are removed upon discovery to keep this drainage pathway open.

The IR site potentially affecting Wetland 72 is UST 18 (Crash Crew Training Area) via drainage from Wetland W1.

### **10.23.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-23-1 denotes the Phase IIA Wetland 72 sampling locations.

#### **Sediment**

Seventeen metals were detected in Wetland 72 sediment samples. Copper at location 7201 (38.9 ppm) exceeded the sediment benchmark level (18.7 ppm) at Wetland 72. Three pesticides were detected in Wetland 72 sediment samples, including 4,4'-DDT and its metabolites, at concentrations below basewide levels described in Section 6. No PCBs were detected in Wetland 72 sediment samples. Twelve SVOCs, mostly high and low molecular weight PAHs, were detected in Wetland 72 sediment samples. Fluoranthene at location 7201 (120 ppb) exceeded the sediment screening criteria (113 ppb). The VOCs acetone and methylene chloride were detected in Wetland 72 sediment samples. Acetone and methylene chloride are common laboratory contaminants.

Table 10-23-1 shows the Wetland 72 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-23-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-23-2. The HQs will be further discussed in the ecological risk section (Section 10.23.4).

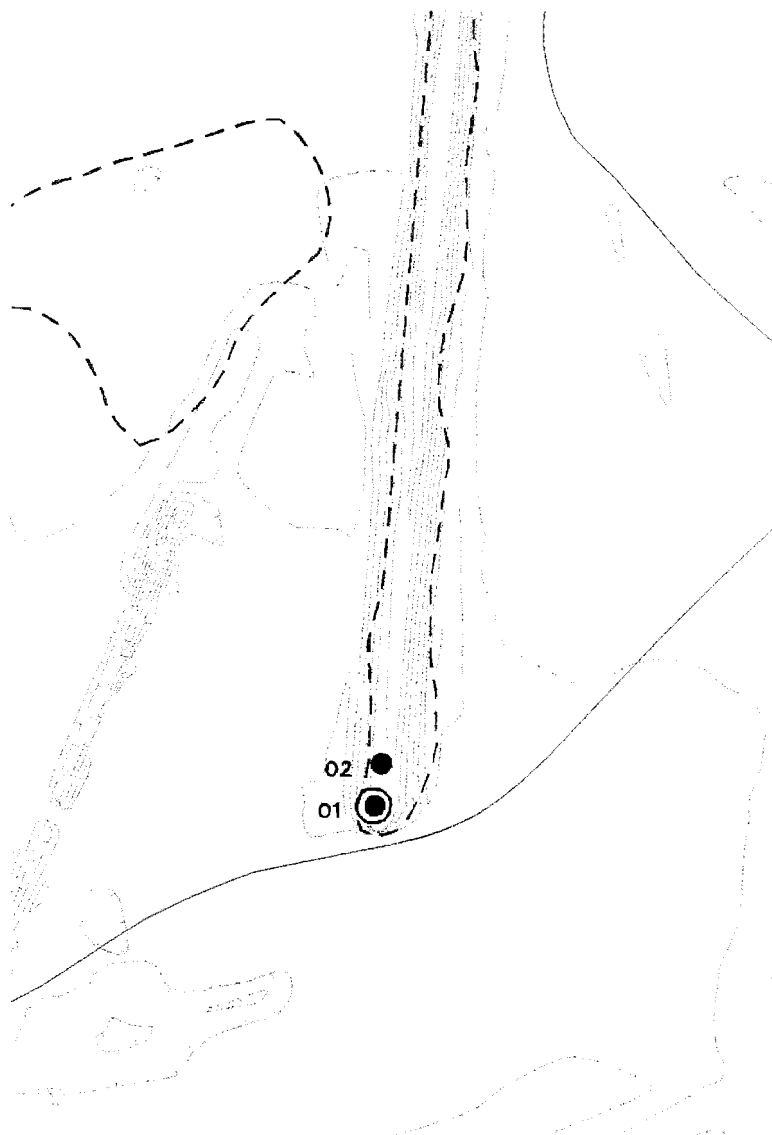
### **Surface Water**

Thirteen metals were detected in the Wetland 72 surface water samples. Aluminum (895 ppb), silver (4.4 ppb) and thallium (5.3 ppb) exceeded the respective surface water quality criteria of 87 ppb, 0.07 ppb, and 4 ppb at Wetland 72. No organics were detected in Wetland 72 surface water sample.

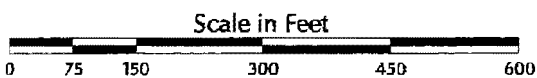
Table 10-23-3 shows the Wetland 72 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-23-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-23-4. The HQs will be further discussed ecological risk section (Section 10.23.4).

### **10.23.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus many evaluations are qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-23-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria were presented on Table 10-23-4.



- Sediment Sample Location
- Surface Water Sample Collected
- Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-23-1  
PHASE IIA WETLAND 72  
SAMPLING LOCATIONS**



Table 10-23-1  
 Phase IIA Detected Concentrations in Wetland 72 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	2/2	736-2450	1593
Arsenic (As)	2/2	0.28-0.86	0.57
Barium (Ba)	2/2	1.3-2.3	1.8
Cadmium (Cd)	1/2	0.27	0.27
Calcium (Ca)	2/2	23.2-43.1	33.15
Chromium (Cr)	2/2	0.85-3.2	2.025
Copper (Cu)	2/2	1.2-38.9	20.05
Iron (Fe)	2/2	397-1510	953.5
Lead (Pb)	2/2	1.8-17.5	9.65
Magnesium (Mg)	2/2	20.3-50	35.15
Manganese (Mn)	2/2	1.3-10.7	6
Nickel (Ni)	1/2	1.4	1.4
Potassium (K)	2/2	8.4-29.7	19.05
Selenium (Se)	1/2	0.26	0.26
Sodium (Na)	2/2	3-8.7	5.85
Vanadium (V)	2/2	1.2-3.8	2.5
Zinc (Zn)	2/2	3.3-10.7	7
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	1/2	0.2	0.2
4,4'-DDE	1/2	0.24	0.24
4,4'-DDT	1/2	0.26	0.26
<b>SVOCs (µg/kg)</b>			
Anthracene	1/2	41	41
Benzo(a)anthracene	1/2	47	47
Benzo(a)pyrene	1/2	43	43
Benzo(b)fluoranthene	1/2	90	90
Benzo(g,h,i)perylene	1/2	58	58

Table 10-23-1  
 Phase IIA Detected Concentrations in Wetland 72 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>SVOCs (<math>\mu\text{g/kg}</math>) (Continued)</b>			
Benzo(k)fluoranthene	1/2	27	27
Chrysene	1/2	47	47
Di-n-butylphthalate	1/2	43	43
Fluoranthene	2/2	30-120	75
Indeno(1,2,3-cd)pyrene	1/2	47	47
Phenanthrene	1/2	49	49
Pyrene	2/2	38-98	68
<b>VOCs (<math>\mu\text{g/kg}</math>)</b>			
Acetone	1/2	32	32
Methylene chloride	1/2	740	740

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb) except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland 72 through this pathway:

- Potential storm water runoff and sediment entrainment from the northwest side of Forrest Sherman airfield complex. During high tides and storm surges, surface water from Bayou Grande may enter the wetland.

The presence of a single sediment contaminant above benchmark level (see Table 10-23-5) validates the sediment transport pathway (albeit not greatly significant) and by inference the surface water pathway. Additionally, silver and thallium were present in surface water above standards, further validating the pathway.

Table 10-23-2  
**Wetland 72**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M720201</b>					
041M720201	4,4'-DDD (UG/KG)	0.2 J	1.22	0.16	b
041M720201	Arsenic (MG/KG)	0.28 J	7.24	0.04	a b
041M720201	Chromium (MG/KG)	0.85 J	52.3	0.02	a b
041M720201	Copper (MG/KG)	1.2 J	18.7	0.06	a b
041M720201	Fluoranthene (UG/KG)	30 J	113	0.27	b
041M720201	Lead (MG/KG)	1.8	30.2	0.06	a b
041M720201	Pyrene (UG/KG)	38 J	153	0.25	b
041M720201	Zinc (MG/KG)	1.3	124	0.03	a b

**041M720201**

4,4'-DDD (UG/KG)	0.2 J	1.22	0.16	b
Arsenic (MG/KG)	0.28 J	7.24	0.04	a b
Chromium (MG/KG)	0.85 J	52.3	0.02	a b
Copper (MG/KG)	1.2 J	18.7	0.06	a b
Fluoranthene (UG/KG)	30 J	113	0.27	b
Lead (MG/KG)	1.8	30.2	0.06	a b
Pyrene (UG/KG)	38 J	153	0.25	b
Zinc (MG/KG)	1.3	124	0.03	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.
- Basewide levels (detailed in Section 6) for DDT and its metabolites:
- Basewide level for 4,4'-DDE is 40 ppb.
  - Basewide level for 4,4'-DDD is 50 ppb.
  - Basewide level for 4,4'-DDT is 20 ppb.

Table 10-23-3  
 Phase IIA Detected Concentrations in Wetland 72 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	895	895
Barium (Ba)	1/1	8.8	8.8
Calcium (Ca)	1/1	11000	11000
Copper (Cu)	1/1	5.2	5.2
Iron (Fe)	1/1	559	559
Magnesium (Mg)	1/1	1140	1140
Manganese (Mn)	1/1	6.1	6.1
Potassium (K)	1/1	597	597
Silver (Ag)	1/1	4.4	4.4
Sodium (Na)	1/1	3870	3870
Thallium (Tl)	1/1	5.3	5.3
Vanadium (V)	1/1	3	3
Zinc (Zn)	1/1	9	9

*Note:*

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, there are no known sources that would contribute contamination to Wetland 72 through this pathway. Therefore, the pathway is considered invalid.

### **Transport within the Wetland**

#### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landlond analysis, indicates that surface water and sediment movement is towards Wetland 39, and from there to Bayou Grande. Therefore, both sediment and surface water contamination can be expected to remain mobile.

Table 10-23-4 (1)

## Wetland 72

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W720101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	895.0	87.0	10.28736	a
	Copper	UG/L	5.2	7.8	0.66667	a b
	Iron	UG/L	559.0	1,000.0	0.559	a b
	Silver	UG/L	4.4	0.07	62.85714	b
	Thallium	UG/L	5.3	4.0	1.325	a
	Zinc	UG/L	9.0	70.2	0.12821	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-23-5  
 Calculated Sediment Screening Values for Wetland 72

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppb)		(ppm)	(ppm)	
Copper	7.8 <sup>b</sup>	4.3E+02	336	38.9	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
Fluoranthene	39.8 <sup>a</sup>	2.45E+02	9.01E+03	120	NO

**Notes:**

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

### *Sediment Leaching to Surface Water Pathway*

One inorganic and one organic exceeded their respective sediment benchmark levels, but did not exceed their SSLs. Additionally, those parameters above standards in surface water were not above benchmark levels (which are lower values than SSLs) in sediment, suggesting the source for these contaminants is related to the surface water pathway. The sediment leaching pathway is considered invalid for this wetland, and sediment contamination is not expected to partition to surface water.

### **Transport from Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Wetland 39 and Bayou Grande systems, with some backlashing of surface water into the wetland to be expected during high tides.

#### **10.23.4 Ecological Risk Assessment**

HQs for Wetland 72 sediment samples are presented in Table 10-23-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for copper (2.08) and fluoranthene (1.06) at sample location 7201. Phase IIA surface water results revealed HQs greater than 1 for aluminum (10.29), silver (62.86), and thallium (1.33), also at sample location 7201. HQs greater than 1 indicate the potential for excess risk.

Wetland 72 is a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below screening or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.23.5 Human Health Risk Assessment**

##### **10.23.5.1 Samples Included**

###### **Sediment**

041M720101, 041M720201

###### **Surface Water**

041W720101

##### **10.23.5.2 Current and Future Land Use**

Wetland 72 is a drainage ditch on the north side of Forrest Sherman Field. Though the perimeter road around the airfield crosses Wetland 72, access to this road is restricted, and it is patrolled by base police. The new control tower for the airfield is to the southwest of the wetland, but access to this area is restricted to airfield employees and military personnel.

#### **10.23.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.23.5.4 Sediment COPCs**

As shown in Table 10-23-6, no sediment COPCs were identified.

#### **10.23.5.5 Surface Water COPCs**

As shown in Table 10-23-7, no surface water COPCs were identified.

#### **10.23.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 72.

#### **10.23.6 Conclusions and Recommendations**

Wetland 72 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III. Since no COPCs were identified for Wetland 72, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland 72, no further action is recommended for this wetland.



TABLE 10-23-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 72 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection		
72548	4,4'-DDD	0.2000	J	0.2000	J	UG/KG	041M720201	1 / 2	0.23 - 0.23	0.20	0.20	N/A	92000	57000	C	N/A	NO	BSL	
72559	4,4'-DDE	0.2400	J	0.2400	J	UG/KG	041M720101	1 / 2	0.21 - 0.21	0.24	0.24	N/A	65000	41000	C	N/A	NO	BSL	
50293	4,4'-DDT	0.2600	J	0.2600	J	UG/KG	041M720101	1 / 2	0.21 - 0.21	0.26	0.26	N/A	65000	41000	C	N/A	NO	BSL	
67841	Acetone	32.0000	J	32.0000	J	UG/KG	041M720201	1 / 2	1600.00 - 1600.00	32.00	32.00	N/A	32000000	49000000	N	N/A	NO	BSL	
7429905	Aluminum (Al)	736.0000	J	2450.0000	J	MG/KG	041M720101	2 / 2	NAV	1593.00	2450.00	N/A	320000	490000	N	N/A	NO	BSL	
120127	Anthracene	41.0000	J	41.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	41.00	41.00	N/A	95000000	150000000	N	N/A	NO	BSL	
7440382	Arsenic (As)	0.2800	J	0.8600	J	MG/KG	041M720101	2 / 2	NAV	0.57	0.86	N/A	15	9.2	C	N/A	NO	BSL	
7440393	Barium (Ba)	1.3000	J	2.3000	J	MG/KG	041M720101	2 / 2	NAV	1.80	2.30	N/A	22000	34000	N	N/A	NO	BSL	
56553	Benzo(a)anthracene	47.0000	J	47.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	47.00	47.00	N/A	30000	19000	C	N/A	NO	BSL	
50328	Benzo(a)pyrene	43.0000	J	43.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	43.00	43.00	N/A	3000	1900	C	N/A	NO	BSL	
205992	Benzo(b)fluoranthene	90.0000	J	90.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	90.00	90.00	N/A	30000	19000	C	N/A	NO	BSL	
191242	Benzo(g,h,i)perylene	58.0000	J	58.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	58.00	58.00	N/A	9500000	15000000	N	N/A	NO	BSL	
207089	Benzo(k)fluoranthene	27.0000	J	27.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	27.00	27.00	N/A	300000	190000	C	N/A	NO	BSL	
7440439	Cadmium (Cd)	0.2700	J	0.2700	J	MG/KG	041M720101	1 / 2	0.19 - 0.19	0.27	0.27	N/A	320	490	N	N/A	NO	BSL	
7440702	Calcium (Ca)	23.2000	J	43.1000	J	MG/KG	041M720201	2 / 2	NAV	33.15	43.10	N/A	N/A	2500	N/A	NO	EN	BSL	
7440473	Chromium (Cr)	0.8500	J	3.2000	J	MG/KG	041M720201	2 / 2	NAV	2.03	3.20	N/A	1600	2500	N	N/A	NO	BSL	
218019	Chrysene	47.0000	J	47.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	47.00	47.00	N/A	3000000	1900000	C	N/A	NO	BSL	
7440508	Copper (Cu)	1.2000	J	38.9000	J	MG/KG	041M720201	2 / 2	NAV	20.05	38.90	N/A	13000	20000	N	N/A	NO	BSL	
84742	Di-n-butylphthalate	43.0000	J	43.0000	J	UG/KG	041M720101	1 / 2	410.00 - 410.00	43.00	43.00	N/A	32000000	49000000	N	N/A	NO	BSL	
206440	Fluoranthene	30.0000	J	120.0000	J	UG/KG	041M720101	2 / 2	NAV	75.00	120.00	N/A	13000000	20000000	N	N/A	NO	BSL	
193395	Indeno(1,2,3-cd)pyrene	47.0000	J	47.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	47.00	47.00	N/A	30000	19000	C	N/A	NO	BSL	
7439896	Iron (Fe)	397.0000	J	1510.0000	J	MG/KG	041M720201	2 / 2	NAV	953.50	1510.00	N/A	N/A	N/A	N/A	NO	EN	BSL	
7439921	Lead (Pb)	1.8000	J	17.5000	J	MG/KG	041M720201	2 / 2	NAV	9.65	17.50	N/A	400	400	OSWER	N/A	NO	BSL	
7439954	Magnesium (Mg)	20.3000	J	50.0000	J	MG/KG	041M720101	2 / 2	NAV	35.15	50.00	N/A	N/A	N/A	N/A	NO	EN	BSL	
7439965	Manganese (Mn)	1.3000	J	10.7000	J	MG/KG	041M720201	2 / 2	NAV	6.00	10.70	N/A	15000	23000	N	N/A	NO	BSL	
75092	Methylene chloride	740.0000	J	740.0000	J	UG/KG	041M720101	1 / 2	12.00 - 12.00	740.00	740.00	N/A	2900000	1800000	C	N/A	NO	BSL	
7440020	Nickel (Ni)	1.4000	J	1.4000	J	MG/KG	041M720101	1 / 2	0.76 - 0.76	1.40	1.40	N/A	6300	9827	N	N/A	NO	BSL	
85018	Phenanthrene	49.0000	J	49.0000	J	UG/KG	041M720101	1 / 2	41.00 - 41.00	49.00	49.00	N/A	9500000	15000000	N	N/A	NO	BSL	
7440097	Potassium (K)	8.4000	J	29.7000	J	MG/KG	041M720201	2 / 2	NAV	19.05	29.70	N/A	N/A	N/A	N/A	NO	EN	BSL	
129000	Pyrene	38.0000	J	98.0000	J	UG/KG	041M720201	2 / 2	NAV	68.00	98.00	N/A	9500000	15000000	N	N/A	NO	BSL	
7782492	Selenium (Se)	0.2600	J	0.2600	J	MG/KG	041M720101	1 / 2	0.19 - 0.19	0.26	0.26	N/A	1600	2500	N	N/A	NO	EN	BSL
7440235	Sodium (Na)	3.0000	J	8.7000	J	MG/KG	041M720101	2 / 2	NAV	5.85	8.70	N/A	N/A	N/A	N/A	NO	EN	BSL	
7440522	Vanadium (V)	1.2000	J	3.8000	J	MG/KG	041M720201	2 / 2	NAV	2.50	3.80	N/A	2200	3400	N	N/A	NO	BSL	
7440666	Zinc (Zn)	3.3000	J	10.7000	J	MG/KG	041M720101	2 / 2	NAV	7.00	10.70	N/A	95000	150000	N	N/A	NO	EN	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes Selection Reason:

Deletion Reason:  
Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-23-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 72 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
7429905	Aluminum (Al)	895		895		UG/L	041W720101	1 / 1	NAV	895	895	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	8.8	J	8.8	J	UG/L	041W720101	1 / 1	NAV	8.8	8.8	N/A	8300	18000	N	N/A	NO	BSL
7440702	Calcium (Ca)	11000		11000		UG/L	041W720101	1 / 1	NAV	11000	11000	N/A	N/A	N/A	N	N/A	NO	EN
7440508	Copper (Cu)	5.2	J	5.2	J	UG/L	041W720101	1 / 1	NAV	5.2	5.2	N/A	4800	10000	N	N/A	NO	BSL
7439896	Iron (Fe)	559		559		UG/L	041W720101	1 / 1	NAV	559	559	N/A	N/A	N/A	N	N/A	NO	EN
7439954	Magnesium (Mg)	1140	J	1140	J	UG/L	041W720101	1 / 1	NAV	1140	1140	N/A	N/A	N/A	N	N/A	NO	EN
7439965	Manganese (Mn)	6.1	J	6.1	J	UG/L	041W720101	1 / 1	NAV	6.1	6.1	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	597	J	597	J	UG/L	041W720101	1 / 1	NAV	597	597	N/A	N/A	N/A	N	N/A	NO	EN
7440224	Silver (Ag)	4.4	J	4.4	J	UG/L	041W720101	1 / 1	NAV	4.4	4.4	N/A	500	1300	N	N/A	NO	BSL
7440235	Sodium (Na)	3870	J	3870	J	UG/L	041W720101	1 / 1	NAV	3870	3870	N/A	N/A	N/A	N	N/A	NO	EN
7440280	Thallium (Tl)	5.3	J	5.3	J	UG/L	041W720101	1 / 1	NAV	5.3	5.3	N/A	8.3	18	N	N/A	NO	BSL
7440622	Vanadium (V)	3	J	3	J	UG/L	041W720101	1 / 1	NAV	3	3	N/A	N/A	N/A	N	N/A	NO	BSL
7440666	Zinc (Zn)	9	J	9	J	UG/L	041W720101	1 / 1	NAV	9	9	N/A	36000	76000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(8) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

## **10.24 WETLAND 79**

### **10.24.1 Site Description**

Parsons and Pruitt described Wetland 79 as a palustrine emergent wetland (USEPA, 1991). Wetland 79 is south of Tow Way Road, and east of Forrest Sherman Field, at the south end of IR Site 6 (Fort Redoubt Rubble Disposal Area). Site 6 is a former borrow pit used as a construction demolition landfill from 1973 to 1982 at NAS Pensacola. Wetland 79 sat in a wet depression at the southern end of this former borrow pit. Site 6 was reactivated during the BRAC construction which occurred in 1995, and was used to dispose of demolition materials from Chevalier Field. Because of the amount of rubble requiring disposal, the Navy requested a permit to fill Wetland 79 from the Corps of Engineers. Because Wetland 79 was an isolated, man-induced wetland, the Corps issued the permit. The wetland was subsequently filled, and no longer exists. Wetland 79 data are presented in this RI report for completeness.

### **10.24.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-24-1 denotes the Phase IIA Wetland 79 sampling locations.

#### **Sediment**

Nineteen metals were detected in Wetland 79 sediment samples. Lead at location 7201 (42.7 ppm) exceeded the sediment benchmark level (30.2 ppm) at Wetland 79. Eleven pesticides were detected in Wetland 79 sediment samples, including 4,4'-DDT and its metabolites, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, delta-BHC, and alpha/gamma-chlordane. 4,4'-DDT and its metabolites were detected below basewide levels. Four pesticides exceeded sediment benchmark levels at location 7901. Dieldrin (3.5 ppb), endrin (6.2 ppb), alpha-chlordane (38 ppb), and gamma-chlordane (45 ppb) each exceeded its respective sediment benchmark level at this location. No PCBs were detected in Wetland 72 sediment samples. Twelve SVOCs, mostly high- and low-molecular weight PAHs, were detected in Wetland 79 sediment samples.

Fluoranthene at location 7901 (130 ppb) exceeded its sediment benchmark level (113 ppb). Toluene was the only VOC detected in Wetland 79 sediment samples.

Table 10-24-1 shows the Wetland 79 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-24-2 compares detected concentrations at each location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are provided in Table 10-24-2. The HQs will be further discussed in the ecological risk section (Section 10.24.4).

### **Surface Water**

No surface water samples were collected at Wetland 79.

#### **10.24.3 Fate and Transport**

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Surface water, sediment transport and storm water runoff data are lacking; thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-24-3 presents those contaminants present in sediment above benchmark levels and their calculated SSLs.

### **Transport into the Wetland**

#### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources could have contributed contamination to Wetland 79 through this pathway:

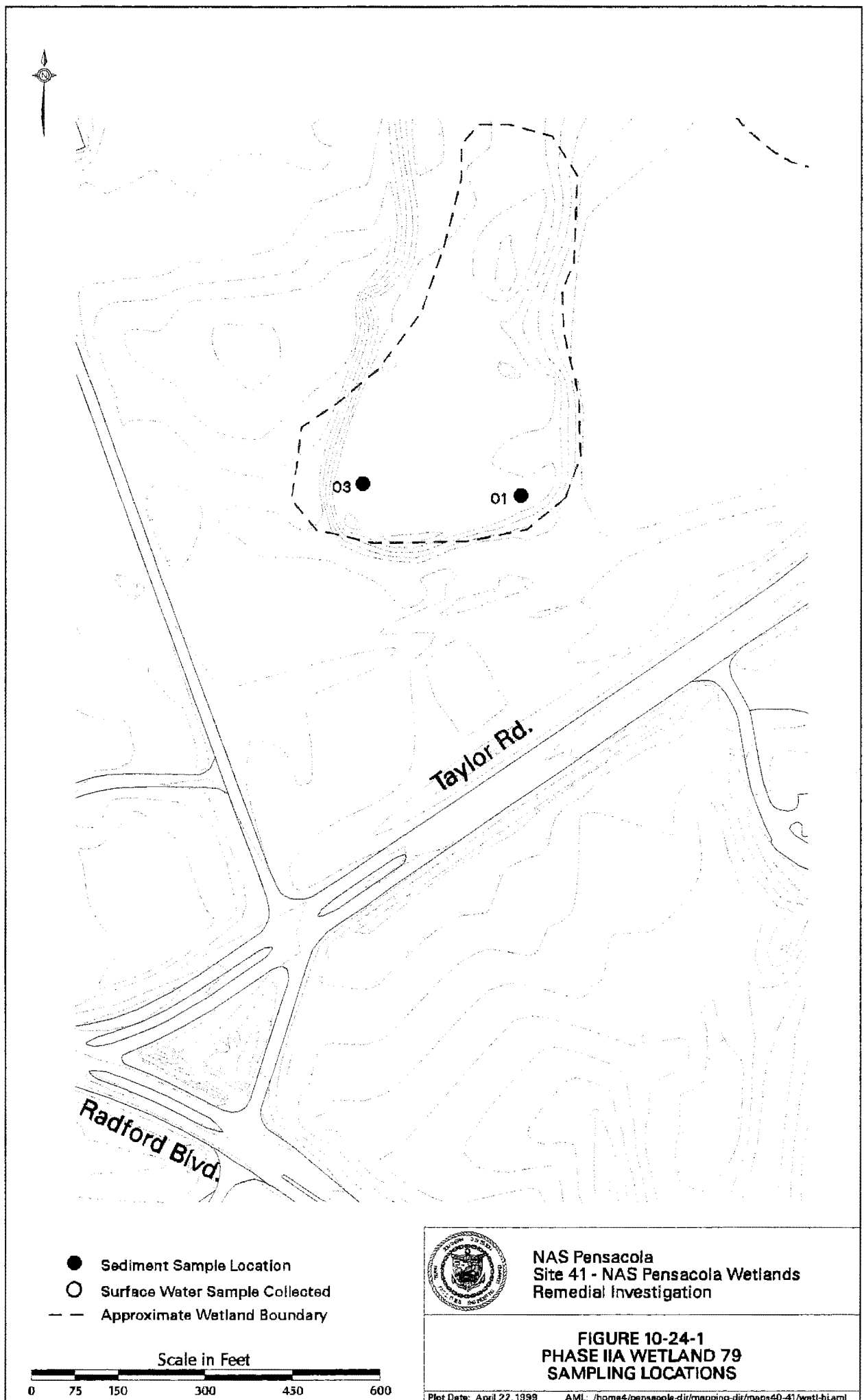


Table 10-24-1  
 Phase IIA Detected Concentrations in Wetland 79 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	2/2	723 - 13600	7161.5
Arsenic (As)	1/2	1.9	1.9
Barium (Ba)	2/2	2.9 - 30.6	16.75
Beryllium (Be)	1/2	0.17	0.17
Calcium (Ca)	1/2	2140	2140
Chromium (Cr)	2/2	0.87 - 15	7.935
Cobalt (Co)	1/2	1	1
Copper (Cu)	2/2	0.64 - 6	3.32
Iron (Fe)	2/2	756 - 9520	5138
Lead (Pb)	2/2	2 - 42.7	22.35
Magnesium (Mg)	2/2	40 - 561	300.5
Manganese (Mn)	2/2	5.7 - 95.4	50.55
Nickel (Ni)	1/2	4.4	4.4
Potassium (K)	2/2	32.6 - 374	203.3
Selenium (Se)	1/2	0.78	0.78
Sodium (Na)	1/2	217	217
Thallium (Tl)	1/2	1.3	1.3
Vanadium (V)	2/2	1.5 - 20.5	11
Zinc (Zn)	1/2	44.7	44.7
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	1/2	14	14
4,4'-DDE	1/2	1.3	1.3
4,4'-DDT	1/2	3.5	3.5
Dieldrin	1/2	3.5	3.5
Endrin	1/2	6.2	6.2
Endrin aldehyde	1/2	0.74	0.74
Heptachlor	1/2	3	3
Heptachlor epoxide	1/2	1.3	1.3
alpha-Chlordane	1/2	38	38
delta-BHC	1/2	0.29	0.29
gamma-Chlordane	1/2	45	45
<b>Semivolatiles (µg/kg)</b>			
4-Methylphenol (p-Cresol)	1/2	170	170
Benzo(a)anthracene	1/2	53	53
Benzo(a)pyrene	1/2	73	73
Benzo(b)fluoranthene	1/2	100	100
Benzo(g,h,i)perylene	1/2	83	83
Benzo(k)fluoranthene	1/2	50	50
Butylbenzylphthalate	2/2	22 - 57	39.5
Chrysene	1/2	67	67
Di-n-butylphthalate	1/2	22	22
Fluoranthene	1/2	130	130

Table 10-24-1  
 Phase IIA Detected Concentrations in Wetland 79 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Semivolatiles (<math>\mu\text{g/kg}</math>)</b>			
Indeno(1,2,3-cd)pyrene	1/2	56	56
Pyrene	1/2	100	100
<b>Volatiles (<math>\mu\text{g/kg}</math>)</b>			
Toluene	1/2	7	7

**Note:**

All results are in micrograms per kilogram ( $\mu\text{g/kg}$ ) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Potential storm water runoff and sediment entrainment from Sites 6, 7, and 5, and the paved areas near the eastern end of the E-W runway for Forrest Sherman Field complex.

The presence of sediment contaminants above SSVs (see Table 10-24-2) validates the sediment transport pathway, and by inference the surface water pathway. Seven organics — six pesticides and one semivolatile — and one inorganic — were detected above their benchmark levels. The nature of the contaminants suggest that the source to the wetland is from local and pesticide application, and runoff associated with the fuels from the airfield.

*Groundwater Discharge Pathway*

Based on potentiometric analysis, the following sources can contribute contamination to Wetland 79 through this pathway:

- Discharge from Sites 6, 7, 5 and 17. Groundwater from these sites have not been found to be contaminated, thus the pathway is considered invalid.

Table 10-24-2  
Wetland 79  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041M790301</b>					
041M790301	Aluminum (MG/KG)	15.3	1.00	1.58	a
041M790301	Barium (MG/KG)	1.12	1.00	1.00	a
041M790301	Boron (MG/KG)	0.07	1.00	1.00	a
041M790301	Bromine (MG/KG)	1.00	1.00	1.00	a
041M790301	Calcium (MG/KG)	1.12	1.00	1.00	a
041M790301	Chlorine (MG/KG)	1.12	1.00	1.00	a
041M790301	Copper (MG/KG)	0.07	1.00	1.00	a
041M790301	Iron (MG/KG)	1.12	1.00	1.00	a
041M790301	Lead (MG/KG)	0.07	1.00	1.00	a
041M790301	Magnesium (MG/KG)	1.12	1.00	1.00	a
041M790301	Manganese (MG/KG)	0.07	1.00	1.00	a
041M790301	Mercury (MG/KG)	0.07	1.00	1.00	a
041M790301	Nickel (MG/KG)	0.07	1.00	1.00	a
041M790301	Phosphorus (MG/KG)	0.07	1.00	1.00	a
041M790301	Potassium (MG/KG)	1.12	1.00	1.00	a
041M790301	Selenium (MG/KG)	0.07	1.00	1.00	a
041M790301	Silver (MG/KG)	0.07	1.00	1.00	a
041M790301	Sulfur (MG/KG)	1.12	1.00	1.00	a
041M790301	Zinc (MG/KG)	0.07	1.00	1.00	a
041M790301	Chromium (MG/KG)	0.07	52.9	0.02	a b
041M790301	Copper (MG/KG)	0.07	18.7	0.03	a b
041M790301	Lead (MG/KG)	0.07	30.2	0.07	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 5) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.



Table 10-24-3  
 Calculated Sediment Screening Values for Wetland 79  
 NAS Pensacola Site 41

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppm)		(ppm)	(ppm)	
Lead	1.17 <sup>b</sup>	9E+02	154	42.7	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4'- DDD	0.0064 <sup>a</sup>	3.56E+04	2.28E+04	14	NO
4,4'- DDT	0.001 <sup>a, b</sup>	9.35E+04	9.35E+03	3.5	NO
Chlordane (alpha and gamma)	0.0043 <sup>a, b</sup>	4.27E+03	1.71E+03	45	NO
Dieldrin	0.0019 <sup>a, b</sup>	7.62E+02	1.45E+02	3.5	NO
Endrin	0.0023 <sup>a, b</sup>	4.37E+02	1E+02	6.2	NO
Fluoranthene	39.8 <sup>a</sup>	3.81E+03	1.52E+07	130	NO

**Notes:**

Kd for organics calculated using foc of 0.0356 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

## Transport within the Wetland

### Surface Water/Sediment Migration Pathway

The configuration of wetland, along with landform analysis, indicates that the wetland is self-enclosed, and does not feed another drainage pathway. Therefore, sediment contamination can be expected to remain within the wetland, and impetus for movement within the wetland influenced only by the direction(s) of storm water influx.

### Sediment Leaching to Surface Water Pathway

Seven organics and one inorganic exceeded their respective benchmark levels. None exceeded their calculated SSL. Therefore, this pathway is considered invalid.

### **Transport from the Wetland**

Physiographic analysis suggests that the wetland is self-enclosed, and is not directly connected to another feature via direct surface water drainage. Therefore this pathway is considered invalid, and sediment contamination remain within the wetland.

#### **10.24.4 Ecological Risk Assessment**

HQs for Wetland 79 sediment samples are presented in Table 10-24-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark level revealed HQs above 1 for lead (1.41), fluoranthene (1.15), and the pesticides 4,4'-DDD (11.48), 4,4'-DDT (2.94), dieldrin (4.90), endrin (1.88), alpha-chlordane (22.35), and gamma-chlordane (26.47). As noted in the nature and extent section, the concentrations of 4,4'-DDD and 4,4'-DDT were below basewide levels. All HQs greater than 1 in Wetland 79 sediment samples occurred at sample location 7901. HQs greater than 1 indicate the potential for excess risk.

Wetland 79 is a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below screening or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.24.5 Human Health Risk Assessment**

##### **10.24.5.1 Samples Included**

###### **Sediment**

041M790101, 041M790301

#### **10.24.5.2 Current and Future Land Use**

Wetland 79 was at the south end of IR Site 6, the base construction debris landfill. During the construction of the NATTC in 1996, this landfill was expanded using debris from the demolition of the former NADEP facilities at Chevalier Field. After receiving a permit from the Corps of Engineers, the expansion of the landfill encompassed Wetland 79, which was buried with concrete debris. The area can be expected to continue to be used for this purpose in the future.

#### **10.24.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.24.5.4 Sediment COPCs**

As shown in Table 10-24-4, no sediment COPCs were identified.

#### **10.24.5.5 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 79.

#### **10.24.6 Conclusions and Recommendations**

Because of the reactivation of the Site 6 construction and demolition landfill at NAS Pensacola, Wetland 79 was filled under a Corps of Engineers permit and no longer exists. Therefore, no further action is recommended for Wetland 79.

TABLE 10-24-4  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 79 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser Screening Toxicity Value	(5) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAA/TBC Source	COPC Flag	(6) Rationale for Contaminant Deletion or Selection	
72548	4,4'-DDD	14.0000	J	14.0000	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	14.00	14.00	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	1.3000	J	1.3000	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	1.3	1.3	N/A	65000	41000	C	N/A	NO	BSL
50293	4,4'-DDT	3.5000	J	3.5000	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	3.5	3.5	N/A	65000	41000	C	N/A	NO	BSL
106445	4-Methylphenol (p-Cresol)	170.0000	J	170.0000	J	UG/KG	041M790101	1 / 2	420.00 - 420.00	170	170	N/A	1600000	2500000	N	N/A	NO	BSL
7440382	Arsenic (As)	1.9000	J	1.9000	J	MG/KG	041M790301	1 / 2	0.14 - 0.14	1.9	1.9	N/A	15	9	C	N/A	NO	BSL
56553	Benzo(a)anthracene	53.0000	J	53.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	53	53	N/A	30000	19000	C	N/A	NO	BSL
50328	Benzo(a)pyrene	73.0000	J	73.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	73	73	N/A	3000	1900	C	N/A	NO	BSL
205992	Benzo(b)fluoranthene	100.0000	J	100.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	100	100	N/A	30000	19000	C	N/A	NO	BSL
191242	Benzo(g,h,i)perylene	83.0000	J	83.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	83	83	N/A	9500000	15000000	N	N/A	NO	BSL
207099	Benzo(k)fluoranthene	50.0000	J	50.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	50	50	N/A	300000	190000	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.1700	J	0.1700	J	MG/KG	041M790101	1 / 2	0.07 - 0.07	0.17	0.17	N/A	630	980	N	N/A	NO	BSL
7440702	Calcium (Ca)	2140.0000	J	2140.0000	J	MG/KG	041M790101	1 / 2	66.40 - 66.40	2140	2140	N/A	N/A	N/A	N/A	N/A	NO	EN
218019	Chrysene	67.0000	J	67.0000	J	UG/KG	041M790101	1 / 2	420.00 - 420.00	67	67	N/A	3000000	1900000	C	N/A	NO	BSL
7440484	Cobalt (Co)	1.0000	DJ	1.0000	DJ	MG/KG	041M790101	1 / 2	0.14 - 0.14	1	1	N/A	19000	29000	N	N/A	NO	BSL
84742	Di-n-butylphthalate	22.0000	J	22.0000	J	UG/KG	041M790301	1 / 2	880.00 - 880.00	22	22	N/A	32000000	49000000	N	N/A	NO	BSL
60571	Dieldrin	3.5000	J	3.5000	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	3.5	3.5	N/A	1400	860	C	N/A	NO	BSL
72208	Endrin	6.2000	J	6.2000	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	6.2	6.2	N/A	95000	150000	N	N/A	NO	BSL
7421934	Endrin aldehyde	0.7400	J	0.7400	J	UG/KG	041M790101	1 / 2	0.22 - 0.22	0.74	0.74	N/A	95000	150000	N	N/A	NO	BSL
206440	Fluoranthene	130.0000	DJ	130.0000	DJ	UG/KG	041M790101	1 / 2	42.00 - 42.00	130	130	N/A	13000000	20000000	N	N/A	NO	BSL
76448	Heptachlor	3.0000	J	3.0000	J	UG/KG	041M790101	1 / 2	0.11 - 0.11	3	3	N/A	4900	3000	C	N/A	NO	BSL
1024573	Heptachlor epoxide	1.3000	J	1.3000	J	UG/KG	041M790101	1 / 2	0.11 - 0.11	1.3	1.3	N/A	2400	1500	C	N/A	NO	BSL
193395	Indeno(1,2,3-cd)pyrene	56.0000	J	56.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	56	56	N/A	30000	19000	C	N/A	NO	BSL
7440020	Nickel (Ni)	4.4000	J	4.4000	J	MG/KG	041M790101	1 / 2	0.61 - 0.61	4.4	4.4	N/A	6300	9800	N	N/A	NO	BSL
129000	Pyrene	100.0000	J	100.0000	J	UG/KG	041M790101	1 / 2	42.00 - 42.00	100	100	N/A	9500000	15000000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.7800	J	0.7800	J	MG/KG	041M790101	1 / 2	0.27 - 0.27	0.78	0.78	N/A	1600	2500	N	N/A	NO	EN
7440235	Sodium (Na)	217.0000	J	217.0000	J	MG/KG	041M790101	1 / 2	8.50 - 8.50	217	217	N/A	N/A	N/A	N/A	N/A	NO	EN
7440280	Thallium (Tl)	1.3000	J	1.3000	J	MG/KG	041M790101	1 / 2	0.27 - 0.27	1.3	1.3	N/A	22	34	N	N/A	NO	BSL
108883	Toluene	7.0000	J	7.0000	J	UG/KG	041M790101	1 / 2	12.00 - 12.00	7	7	N/A	63000000	98000000	N	N/A	NO	BSL
7440666	Zinc (Zn)	44.7000	J	44.7000	J	MG/KG	041M790101	1 / 2	3.20 - 3.20	44.7	44.7	N/A	95000	150000	N	N/A	NO	EN
5103719	alpha-Chlordane	38.0000	J	38.0000	J	UG/KG	041M790101	1 / 2	0.11 - 0.11	38	38	N/A	63000	39000	C	N/A	NO	BSL
319868	delta-BHC	0.2900	J	0.2900	J	UG/KG	041M790101	1 / 2	0.11 - 0.11	0.29	0.29	N/A	12000	7600	C	N/A	NO	BSL
5103742	gamma-Chlordane	45.0000	J	45.0000	J	UG/KG	041M790101	1 / 2	0.11 - 0.11	45	45	N/A	63000	39000	C	N/A	NO	BSL
7429905	Aluminum (Al)	723.0000	J	13600.0000	J	MG/KG	041M790301	2 / 2	NAV	7162	13600	N/A	320000	490000	N	N/A	NO	BSL
7440393	Barium (Ba)	2.9000	J	30.6000	J	MG/KG	041M790301	2 / 2	NAV	16.8	30.6	N/A	22000	34000	N	N/A	NO	BSL
85687	Butylbenzylphthalate	22.0000	J	57.0000	J	UG/KG	041M790101	2 / 2	NAV	39.5	57	N/A	63000000	98000000	N	N/A	NO	BSL
7440473	Chromium (Cr)	0.8700	J	15.0000	J	MG/KG	041M790101	2 / 2	NAV	7.94	15	N/A	1600	2500	N	N/A	NO	BSL
7440508	Copper (Cu)	0.6400	J	6.0000	J	MG/KG	041M790101	2 / 2	NAV	3.32	6	N/A	13000	20000	N	N/A	NO	BSL
7439896	Iron (Fe)	756.0000	J	9520.0000	J	MG/KG	041M790101	2 / 2	NAV	5138	9520	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	2.0000	J	42.7000	J	MG/KG	041M790301	2 / 2	NAV	22.4	42.7	N/A	400	400	N/A	N/A	NO	BSL
7439954	Magnesium (Mg)	40.0000	J	561.0000	J	MG/KG	041M790101	2 / 2	NAV	301	561	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	5.7000	J	95.4000	J	MG/KG	041M790101	2 / 2	NAV	50.6	95.4	N/A	15000	23000	N	N/A	NO	BSL
7440097	Potassium (K)	32.6000	J	374.0000	J	MG/KG	041M790301	2 / 2	NAV	203	374	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	1.5000	J	20.5000	J	MG/KG	041M790101	2 / 2	NAV	11	20.5	N/A	2200	3400	N	N/A	NO	BSL

- (1) Minimum/maximum detected concentration  
(2) Maximum concentration used as screening value.  
(3) This chemical was not detected at background sampling locations.  
(4) RBCs for site trespasser scenario. Calculated based on toxicity values presented in USEPA Region III Risk-Based Concentration Tables, 1998.  
(5) RBCs for residential scenario as presented in USEPA Region III Risk-Based Concentration Tables, 1998.  
(6) Rationale Codes  
Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions:

NAV = Not Available  
N/A = Not Applicable  
COPC = Chemical of Potential Concern  
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
J = Estimated Value  
C = Carcinogenic  
N = Noncarcinogenic

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## **10.25 Wetland W2**

### **10.25.1 Site Description**

Wetland W2, also known as the Southeast Drainage Ditch, drains surface and storm water from the northeastern end of Forrest Sherman Field and the Barrancas Cemetery area into the southern portion of Redoubt Bayou. This site was not classified or described by Parsons and Pruitt (USEPA, 1991), but was later added to the list by E&E, Inc. The Wetland W2 drainage system receives surface water from the cemetery area via buried twin-8 foot diameter culverts, which pass to under Taylor Road, emerging on the northwest side of Site 1 adjacent to Wetland 1. This feature continues to the southwest as an open drainage ditch for approximately 1,000 feet until it intersects Wetland W-2 about 900 feet upstream from Redoubt Bayou. Wetland W2 is tidally influenced from Redoubt Bayou to this intersection. An active NPDES permit location exists where the two ditches intersect. Wetland W2 and the intersecting ditch contain emergent vegetation such as cattails (*Typha latifolia*) and duck potato (*Sagittaria sp*). Vegetation is periodically cleared from this system to facilitate the free flow of water.

The IR site potentially affecting Wetland W2 is Site 16 (Brush Disposal Site), the disposal site for tree pruning and trimming from the late 1960s.

### **10.25.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-25-1 denotes the Phase IIA Wetland W2 sampling locations.

#### **Sediment**

Nineteen metals were detected in Wetland W2 sediment samples. Arsenic at location W203 (14.1 ppm) exceeded the sediment benchmark level (7.24 ppm) at Wetland W2. Eight pesticides were detected in Wetland W2 sediment samples, including 4,4'-DDT and its metabolites, aldrin, dieldrin endrin, alpha-chlordane, and delta-BHC. The PCB Aroclor-1260 was also detected in

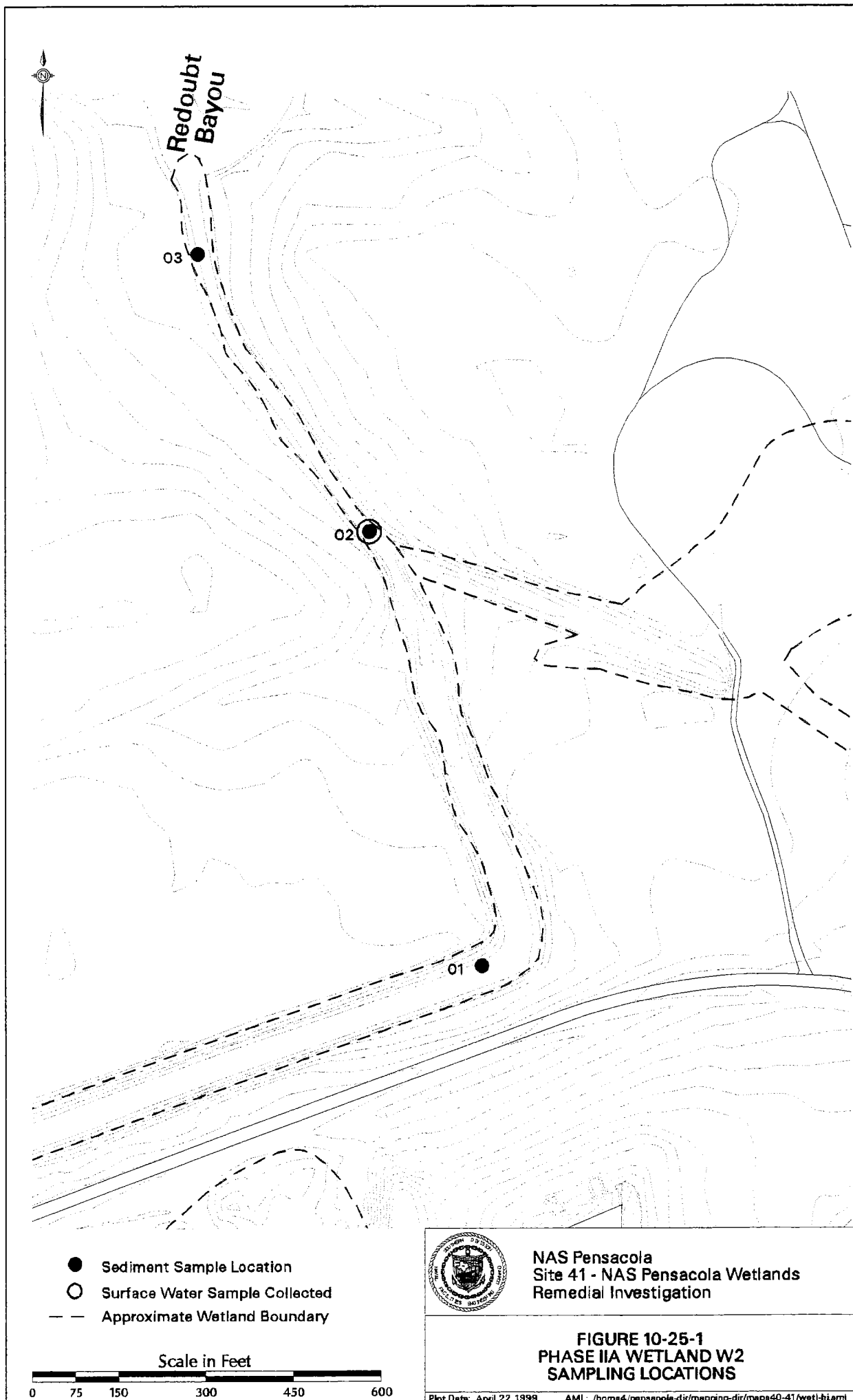
every sample. 4,4'-DDT and its metabolites were below basewide levels. Basewide levels are described in Section 6. No other pesticides or PCBs exceeded benchmark levels at Wetland W2. Nine SVOCs, including high- and low-molecular weight PAHs and phthalate esters, were detected in Wetland W2 sediment samples. Bis(2-ethylhexyl)phthalate exceeded its sediment benchmark level (182 ppb) at location W201 (460 ppb). The VOC acetone, a common laboratory contaminant, was detected in one Wetland W2 sediment samples.

Table 10-25-1 shows the Wetland W2 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-25-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only parameters with benchmark levels are listed in Table 10-25-2. The HQs will be further discussed in the ecological risk section (Section 10.25.4).

### **Surface Water**

Ten metals were detected in the single Wetland W2 surface water sample. Iron (309 ppb) and copper (6.8 ppb) exceeded their surface water quality criteria (300 ppb and 2.9 ppb) at Wetland W2. The SVOC 2-methylnaphthalene was detected in Wetland W2 surface water sample.

Table 10-25-3 shows the Wetland W2 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-25-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only parameters with water quality criteria are presented in Table 10-25-4. The HQs will be further discussed in the ecological risk section (Section 10.25.4).





**Table 10-25-1**  
**Phase IIA Detected Concentrations in Wetland W2 Sediments**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	607-6700	3615.67
Arsenic (As)	2/3	0.5-14.1	7.3
Barium (Ba)	3/3	1-11.5	6.27
Beryllium (Be)	2/3	0.08-0.35	0.22
Cadmium (Cd)	1/3	0.18	0.18
Calcium (Ca)	3/3	285-1250	623
Chromium (Cr)	3/3	0.76-10.2	5.45
Cobalt (Co)	2/3	0.24-3.3	1.77
Copper (Cu)	3/3	1.3-4.7	3.07
Iron (Fe)	3/3	209-5130	2049
Lead (Pb)	3/3	2.3-17.1	9.5
Magnesium (Mg)	3/3	93.5-1660	636.17
Manganese (Mn)	3/3	1.2-6	3.4
Nickel (Ni)	3/3	0.8-9.2	3.77
Potassium (K)	3/3	32-503	207.67
Selenium (Se)	3/3	0.46-1.6	1.12
Sodium (Na)	2/3	254-2430	1342
Vanadium (V)	3/3	1.2-27	11.33
Zinc (Zn)	3/3	4.9-10.4	7.67
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDD	2/3	0.8-5.8	3.33
4,4'-DDE	2/3	0.38-2.4	1.39
4,4'-DDT	2/3	0.28-3.5	1.89
Aldrin	1/3	0.23	0.23
Aroclor-1260	3/3	1.7-5.6	3.7
Dieldrin	1/3	0.34	0.34
Endrin	2/3	0.77-2.5	1.64
alpha-Chlordane	2/3	0.14-0.22	0.18
delta-BHC	1/3	0.63	0.63
<b>Semivolatiles (µg/kg)</b>			
Benzo(b)fluoranthene	1/3	28	28
Butylbenzylphthalate	2/3	21-32	26.5
Chrysene	1/3	40	40
Di-n-butylphthalate	2/3	33-39	36
Diethylphthalate	1/3	220	220
Fluoranthene	1/3	47	47
Indeno(1,2,3-cd)pyrene	1/3	26	26
Pyrene	1/3	82	82
bis(2-Ethylhexyl)phthalate (BEHP)	2/3	55-460	257.5
<b>Volatiles (µg/kg)</b>			
Acetone	1/3	210	210

**Note:**

All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-25-2  
Wetland W2  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
<b>041MW20101</b>					
	4,4'-DDD (UG/KG)	5.8 D	1.22	4.75	b
	4,4'-DDE (UG/KG)	2.4 J	2.07	1.18	b
	4,4'-DDT (UG/KG)	3.5 J	1.19	2.94	b
	alpha-Chlordane (UG/KG)	0.14 J	1.7	0.08	a
	Aroclor-1260 (UG/KG)	1.7 J	21.6	0.06	b
	Arsenic (MG/KG)	0.5 J	7.24	0.07	a b
	bis(2-Ethylhexyl)phthalate (BEHP) (UG/KG)	480	182	2.53	b
	Cadmium (MG/KG)	0.18 J	0.68	0.26	a
	Chromium (MG/KG)	5.4	52.3	0.10	a b
	Chrysene (UG/KG)	40 J	108	0.37	b
	Copper (MG/KG)	3.2	18.7	0.17	a b
	Dieldrin (UG/KG)	0.34 J	0.72	0.47	b
	Endrin (UG/KG)	0.77 J	3.3	0.23	a
	Fluoranthene (UG/KG)	47	113	0.42	b
	Lead (MG/KG)	17.1	30.2	0.57	a b
	Nickel (MG/KG)	1.3 J	15.9	0.08	a b
	Pyrene (UG/KG)	82	153	0.54	b
	Zinc (MG/KG)	1.7	124	0.06	a b
<b>041MW20301</b>					
	Aroclor-1260 (UG/KG)	5.6 J	21.6	0.26	b
	Arsenic (MG/KG)	14.1	7.24	1.95	a b
	Chromium (MG/KG)	10.2	52.3	0.20	a b
	Copper (MG/KG)	4.7 J	18.7	0.25	a b
	Endrin (UG/KG)	2.8 J	3.3	0.76	a

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites  
 Basewide level for 4,4'-DDE is 40 ppb,  
 Basewide level for 4,4'-DDD is 50 ppb,  
 Basewide level for 4,4'-DDT is 20 ppb.

Table 10-25-2  
Wetland W2  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
	Lead (MG/KG)	9.1	30.2	0.30	a b
	Nickel (MG/KG)	9.2 J	15.9	0.58	a b
	Zinc (MG/KG)	10.4	124	0.08	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
- (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Basewide levels (detailed in Section 6) for DDT and its metabolites

Basewide level for 4,4'-DDE is 40 ppb.

Basewide level for 4,4'-DDD is 50 ppb.

Basewide level for 4,4'-DDT is 20 ppb.

Table 10-25-3  
 Phase IIA Detected Concentrations in Wetland W2 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentrations
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	1/1	213.00	213.00
Barium (Ba)	1/1	8.20	8.20
Calcium (Ca)	1/1	15000.00	15000.00
Copper (Cu)	1/1	6.80	6.80
Iron (Fe)	1/1	309.00	309.00
Magnesium (Mg)	1/1	1450.00	1450.00
Manganese (Mn)	1/1	17.20	17.20
Potassium (K)	1/1	1870.00	1870.00
Sodium (Na)	1/1	5260.00	5260.00
Zinc (Zn)	1/1	8.80	8.80
<b>Semivolatiles (<math>\mu\text{g/L}</math>)</b>			
2-Methylnaphthalene	1/1	1.00	1.00

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### 10.25.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking: thus many evaluations are qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-25-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs. Contaminants present in surface water above water quality criteria were presented in Table 10-25-4.

Table 10-25-4 (1)

**Wetland W2****Phase IIA Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041WW20201</b>	<b>Saltwater</b>					
	Aluminum	UG/L	213.0	1,500.0	0.142	b
	Copper	UG/L	6.8	2.9	2.34483	a b
	Iron	UG/L	309.0	300.0	1.03	b
	Zinc	UG/L	8.8	86.0	0.10233	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-25-5  
 Calculated Sediment Screening Values for Wetland W2

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	(ppm)		(ppm)	(ppm)	
Arsenic	36 <sup>a</sup>	2.9E+01	146	14.1	NO
<b>Organics</b>	(ppb)		(ppb)	(ppb)	
4,4 DDE	0.14 <sup>a</sup>	2.77E+05	2.9E+08	2.4	NO
4,4 DDD	0.025 <sup>a</sup>	6.2E+04	3.97E+04	5.8	NO
4,4 DDT	0.001 <sup>ab</sup>	1.63E+05	1.63E+04	3.5	NO
Bis(2-ethylhexyl)phthalate	3 <sup>b</sup>	9.37E+05	2.81E+07	460	NO

**Notes:**

Kd for organics calculated using foc of .062 (numerical average of all sediment samples).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Saltwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class I Water Quality Criteria (1996).

## Transport into the Wetland

### Surface Water/Sediment Pathway

Based on landform and watershed analysis, the following sources can contribute contamination to Wetland W2 through this pathway:

- Potential storm water runoff and sediment entrainment from Sites 16, 5, 6, and the east end of the E-W runway for Forrest Sherman Field. There is direct surface water drainage from Wetland 1 (which receives runoff from Sites 1 and 16), and a direct surface water connection to Bayou Redoubt. Back flushing of surface water in a landward direction during high tides and storm events can be expected.

The presence of sediment contaminants above benchmark levels (see Table 10-25-5) validates the sediment transport pathway, and by inference the surface water pathway. No surface water contaminants were detected.

#### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the following sources can contribute contamination to Wetland W2 through this pathway:

- Discharge from Sites 16, 5, and 6. Groundwater at these sites has not been shown to be contaminated, thus the pathway is considered invalid.

#### **Transport within the Wetland**

##### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landform analysis, indicates that surface water and sediment movement is towards Wetland 1 and Bayou Redoubt. However, tidal fluctuations can create a temporary landward movement. Therefore, both sediment and surface water contaminants can be expected remain mobile.

##### *Sediment Leaching to Surface Water Pathway*

One metal, one SVOC, and three pesticides exceeded their sediment benchmark levels (see Table 10-25-5). None of the parameters exceeded their calculated SSL and corresponding detections of arsenic, SVOCs or pesticides were not noted in the surface water sample. Given the lack of parameters above SSLs, this pathway is considered invalid.

#### **Transport from the Wetland**

Surface water and sediment movement can be expected to occur from the wetland into Wetland 1 and Bayou Redoubt, and sediment contamination will remain mobile.

#### **10.25.4 Ecological Risk Assessment**

HQs for Wetland W2 sediment samples are presented in Table 10-25-2.

Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for arsenic (1.95) at sample location W203 and bis(2-ethylhexyl)phthalate (2.52) at sample location W201. The sample results also revealed HQs above 1 for 4,4'-DDD (4.75), 4,4'-DDE (1.16), and 4,4'-DDT (2.94), at sample location W201, respectively. However, as noted in the nature and extent discussion, these concentrations of 4,4'-DDT and its metabolites were below basewide levels. Phase IIA surface water results revealed HQs greater than 1 for copper (2.34), and iron (1.03) at sample location W202. HQs greater than 1 indicate the potential for excess risk.

Wetland W2 is a blue-coded wetland (E/A&H, 1995a). Contaminants detected in the blue-coded wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, the blue-coded wetlands were not studied further in Phase IIB/III. Color-codes, groupings and rationale for classification are described in Section 7.

#### **10.25.5 Human Health Risk Assessment**

##### **10.25.5.1 Samples Included**

###### **Sediment**

041MW20101, 041MW20201, 041MW20301

###### **Surface Water**

041WW20201



#### **10.25.5.2 Current and Future Land Use**

Wetland W2 is west of IR site 16, and east of the perimeter road that circumvents Forrest Sherman Field. The area is a part of the over-run for Runway 07/25, the main runway used at the airfield, and has restricted access. Wetland W-2 is used solely as a drainage ditch, so it has no recreational swimming or fishing use. Maintenance workers might occasionally trespass in the area surrounding this wetland. However, airfield security personnel and base police patrol this area to keep the general public away.

#### **10.25.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.25.5.4 Sediment COPCs**

As shown in Table 10-25-6, no sediment COPCs were identified.

#### **10.25.5.5 Surface Water COPCs**

As shown in Table 10-25-7, no surface water COPCs were identified.

#### **10.25.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland W2.

#### **10.25.6 Conclusions and Recommendations**

Wetland W2 is classified as a blue-coded wetland, where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. The blue-coded wetlands were not studied further in Phase IIB/III. Since no COPCs were identified for Wetland W2, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland W2, no further action is recommended for this wetland.

TABLE 10-25-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland W2 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	0.86		5.80	D	UG/KG	041MW20201	2 / 3	0.91 - 0.91	2.00	5.80	N/A	92000	57000	C	N/A	NO	BSL
72559	4,4'-DDE	0.38	J	2.40	J	UG/KG	041MW20101	2 / 3	0.91 - 0.91	2.00	2.40	N/A	65000	41000	C	N/A	NO	BSL
50293	4,4'-DDT	0.28	J	3.50	J	UG/KG	041MW20201	2 / 3	0.91 - 0.91	2.00	3.50	N/A	65000	41000	C	N/A	NO	BSL
67641	Acetone	210.00		210.00		UG/KG	041MW20301	1 / 3	28.00 - 54.00	1.00	210.00	N/A	32000000	49000000	N	N/A	NO	BSL
309002	Aldrin	0.23	J	0.23	J	UG/KG	041MW20101	1 / 3	0.10 - 0.46	1.00	0.23	N/A	1300	810	C	N/A	NO	BSL
5103719	alpha-Chlordane	0.14	J	0.22	J	UG/KG	041MW20101	2 / 3	0.46 - 0.46	2.00	0.22	N/A	63000	39000	C	N/A	NO	BSL
7429905	Aluminum (Al)	607.00		6700.00		MG/KG	041MW20101	3 / 3	NAV	3615.67	6700.00	N/A	32000	490000	N	N/A	NO	BSL
11096825	Aroclor-1260	1.70	J	5.60	J	UG/KG	041MW20101	3 / 3	NAV	3.70	5.60	N/A	11000	6900	C	N/A	NO	BSL
7440382	Arsenic (As)	0.50	J	14.10	J	MG/KG	041MW20101	2 / 3	0.14 - 0.14	2.00	14.10	N/A	15	9.2	C	N/A	NO	BSL
7440393	Barium (Ba)	1.00	J	11.50	J	MG/KG	041MW20101	3 / 3	NAV	6.27	11.50	N/A	22000	34000	N	N/A	NO	BSL
205992	Benzo(b)fluoranthene	28.00	J	28.00	J	UG/KG	041MW20101	1 / 3	41.00 - 370.00	1.00	28.00	N/A	30000	19000	C	N/A	NO	BSL
7440417	Beryllium (Be)	0.08	J	0.35	J	MG/KG	041MW20301	2 / 3	0.07 - 0.07	2.00	0.35	N/A	630	980	N	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	55.00	J	460.00	J	UG/KG	041MW20201	2 / 3	3700.00 - 3700.00	2.00	460.00	N/A	1600000	980000	C	N/A	NO	BSL
85687	Butylbenzylphthalate	21.00	J	32.00	J	UG/KG	041MW20201	2 / 3	3700.00 - 3700.00	2.00	32.00	N/A	63000000	98000000	N	N/A	NO	BSL
7440439	Cadmium (Cd)	0.18	J	0.18	J	MG/KG	041MW20301	1 / 3	0.14 - 0.62	1.00	0.18	N/A	320	490	N	N/A	NO	BSL
7440702	Calcium (Ca)	285.00	J	1250.00	J	MG/KG	041MW20201	3 / 3	NAV	623.00	1250.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440473	Chromium (Cr)	0.76		10.20		MG/KG	041MW20101	3 / 3	NAV	5.45	10.20	N/A	1600	2500	N	N/A	NO	BSL
218019	Chrysene	40.00	J	40.00	J	UG/KG	041MW20101	1 / 3	41.00 - 370.00	1.00	40.00	N/A	3000000	1900000	C	N/A	NO	BSL
7440484	Cobalt (Co)	0.24	J	3.30	J	MG/KG	041MW20301	2 / 3	0.14 - 0.14	2.00	3.30	N/A	19000	29000	N	N/A	NO	BSL
7440508	Copper (Cu)	1.30	J	4.70	J	MG/KG	041MW20301	3 / 3	NAV	3.07	4.70	N/A	13000	20000	N	N/A	NO	BSL
319868	delta-BHC	0.63		0.63		UG/KG	041MW20101	1 / 3	0.10 - 0.46	1.00	0.63	N/A	12000	7600	C	N/A	NO	BSL
60571	Dieldrin	0.34	J	0.34	J	UG/KG	041MW20101	1 / 3	0.21 - 0.91	1.00	0.34	N/A	1400	860	C	N/A	NO	BSL
84662	Diethylphthalate	220.00	J	220.00	J	UG/KG	041MW20301	1 / 3	410.00 - 430.00	1.00	220.00	N/A	250000000	390000000	N	N/A	NO	BSL
84742	Di-n-butylphthalate	33.00	J	39.00	J	UG/KG	041MW20101	2 / 3	3700.00 - 3700.00	2.00	39.00	N/A	32000000	49000000	N	N/A	NO	BSL
72208	Endrin	0.77	J	2.50	J	UG/KG	041MW20101	2 / 3	0.21 - 0.21	2.00	2.50	N/A	95000	150000	N	N/A	NO	BSL
205440	Fluoranthene	47.00		47.00		UG/KG	041MW20101	1 / 3	41.00 - 370.00	1.00	47.00	N/A	13000000	20000000	N	N/A	NO	BSL
193395	Indeno(1,2,3-cd)pyrene	26.00	J	26.00	J	UG/KG	041MW20101	1 / 3	41.00 - 370.00	1.00	26.00	N/A	30000	19000	C	N/A	NO	BSL
7439896	Iron (Fe)	209.00		5130.00		MG/KG	041MW20301	3 / 3	NAV	2049.00	5130.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439921	Lead (Pb)	2.30		17.10		MG/KG	041MW20101	3 / 3	NAV	9.50	17.10	N/A	400	400	N/A	N/A	NO	BSL
7439954	Magnesium (Mg)	93.50	J	1660.00	J	MG/KG	041MW20201	3 / 3	NAV	636.17	1660.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	1.20		6.00		MG/KG	041MW20101	3 / 3	NAV	3.40	6.00	N/A	15000	23000	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.80	J	9.20	J	MG/KG	041MW20101	3 / 3	NAV	3.77	9.20	N/A	6300	9800	N	N/A	NO	BSL
7440097	Potassium (K)	32.00	J	503.00	J	MG/KG	041MW20101	3 / 3	NAV	207.67	503.00	N/A	N/A	N/A	N/A	N/A	NO	EN
129000	Pyrene	82.00		82.00		UG/KG	041MW20101	1 / 3	41.00 - 370.00	1.00	82.00	N/A	9500000	15000000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.46	J	1.60	J	MG/KG	041MW20101	3 / 3	NAV	1.12	1.60	N/A	1600	2500	N	N/A	NO	BSL
7440235	Sodium (Na)	254.00	J	2430.00	J	MG/KG	041MW20301	2 / 3	6.30 - 6.30	2.00	2430.00	N/A	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	1.20	J	27.00	J	MG/KG	041MW20101	3 / 3	NAV	11.33	27.00	N/A	2200	3400	N	N/A	NO	BSL
7440666	Zinc (Zn)	4.90		10.40		MG/KG	041MW20101	3 / 3	NAV	7.67	10.40	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

**TABLE 10-25-7  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland W2 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection	
91576	2-Methylnaphthalene	1		1		UG/L	041WWW20201	1 / 1	NAV	1	1	N/A	330	1000	N	N/A	NO	BSL
7429905	Aluminum (Al)	213		213		UG/L	041WWW20201	1 / 1	NAV	213	213	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	8.2	J	8.2	J	UG/L	041WWW20201	1 / 1	NAV	8.2	8.2	N/A	8300	18000	N	N/A	NO	BSL
7440702	Calcium (Ca)	15000		15000		UG/L	041WWW20201	1 / 1	NAV	15000	15000	N/A	N/A	N/A	N	N/A	NO	EN
7440508	Copper (Cu)	6.8	J	6.8	J	UG/L	041WWW20201	1 / 1	NAV	6.8	6.8	N/A	4800	10000	N	N/A	NO	BSL
7439896	Iron (Fe)	309		309		UG/L	041WWW20201	1 / 1	NAV	309	309	N/A	N/A	N/A	N	N/A	NO	EN
7439954	Magnesium (Mg)	1450	J	1450	J	UG/L	041WWW20201	1 / 1	NAV	1450	1450	N/A	N/A	N/A	N	N/A	NO	EN
7439965	Manganese (Mn)	17.2		17.2		UG/L	041WWW20201	1 / 1	NAV	17.2	17.2	N/A	2400	5000	N	N/A	NO	BSL
7440097	Potassium (K)	1870	J	1870	J	UG/L	041WWW20201	1 / 1	NAV	1870	1870	N/A	N/A	N/A	N	N/A	NO	EN
7440235	Sodium (Na)	5260		5260		UG/L	041WWW20201	1 / 1	NAV	5260	5260	N/A	N/A	N/A	N	N/A	NO	EN
7440686	Zinc (Zn)	8.8	J	8.8	J	UG/L	041WWW20201	1 / 1	NAV	8.8	8.8	N/A	36000	76000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

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## **10.26 WETLAND 25**

### **10.26.1 Site Description**

Wetland 25 is off Bayou Grande to the west of Redoubt Bayou. Parsons and Pruitt (USEPA, 1991) divided this area into two distinctive sites, Wetlands 25A and 25B. Wetland 25A is small inland palustrine wetland, whereas Wetland 25B is an estuarine wetland lying seaward of Wetland 25A. Wetland 25B is tidally influenced from Bayou Grande. A minor natural surface water drainage pathway runs through Wetland 25A, discharging to the open water part of Wetland 25B. Wetland 25B supports a large stand of black needlerush (*Juncus roemerianus*). No IR sites exist in the vicinity of Wetland 25.

### **10.26.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-26-1 denotes the Phase IIA Wetland 25 sampling locations.

#### **Sediment**

Nineteen metals were detected in Wetland 25 sediment samples. Five metals exceeded sediment benchmark levels at Wetland 25. At sample location 2502, arsenic (8.0 ppm) and lead (32.1 ppm) exceeded benchmark levels. At sample location 2503, arsenic (8.8 ppm), cadmium (1.3 ppm), chromium (59.1 ppm), copper (19.6 ppm), and lead (58.7 ppm) exceeded benchmark levels. Seven pesticides were detected at Wetland 25, including 4,4-DDE, 4,4'-DDT, aldrin, alpha/gamma-BHC, endrin, and alpha-chlordane. 4,4'-DDT at sample location 2501 (1.8ppb) exceeded its benchmark level of 1.19 ppb. However, 4,4'-DDD and 4,4'-DDT detections were below basewide levels (see Section 6). Gamma-BHC at sample location 2503 (1.3 ppb) exceeded its sediment benchmark level (0.32 ppb).

Aroclor-1254 was detected below its sediment benchmark level in all samples. The SVOC benzo(b)fluoranthene was detected at location 2503 below its sediment benchmark criteria.

Two VOCs were detected, acetone at 2503 and tetrachloroethene at 2501. Acetone is a common laboratory contaminant.

Table 10-26-1 shows the Wetland 25 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-26-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented in Table 10-26-2. The HQs will be further discussed in the ecological risk section.

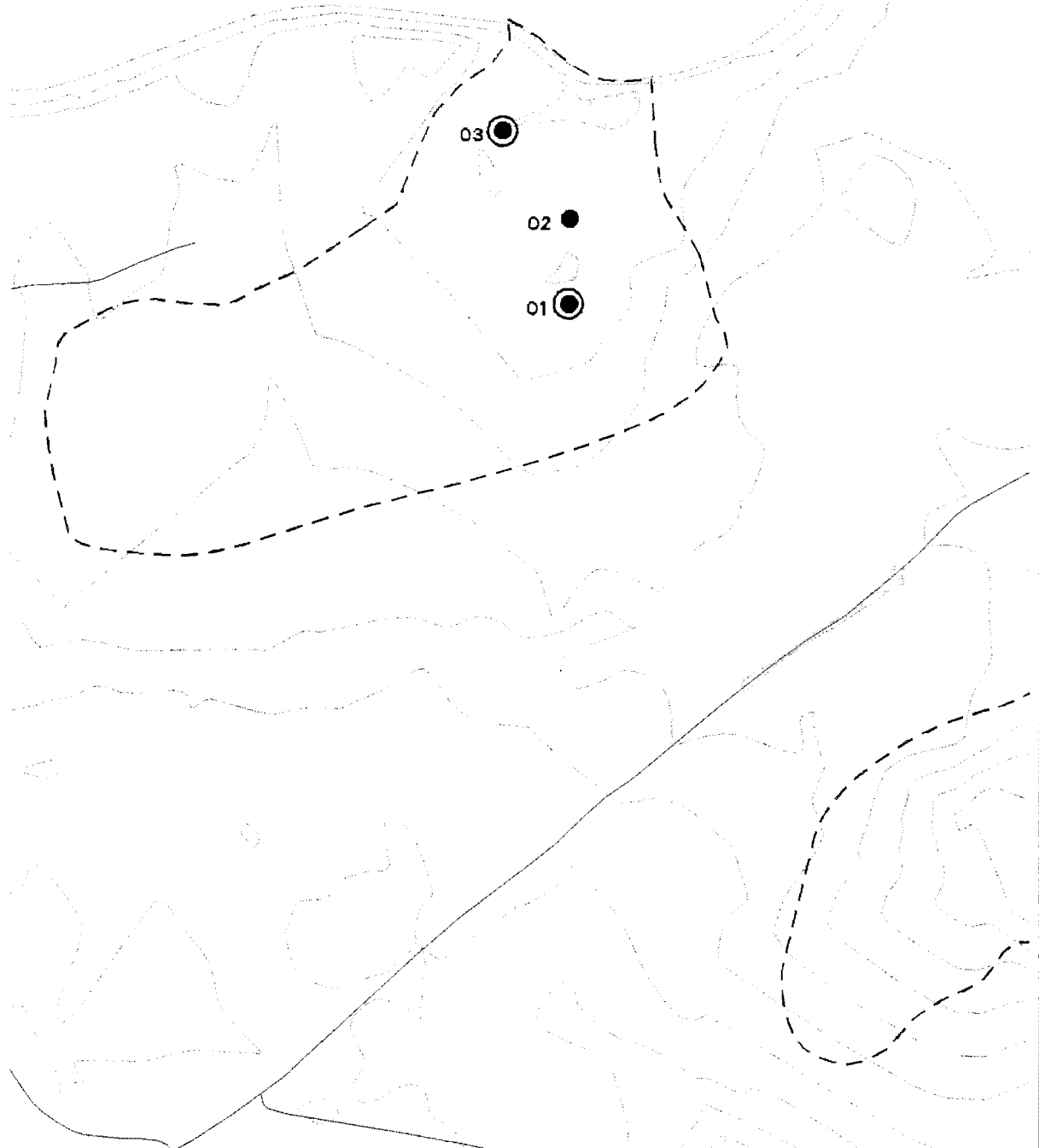
### **Surface Water**

Eleven metals were detected in Wetland 25 surface water samples. Aluminum (1,820 ppb), iron (4,030 ppb), and lead (4.9 ppb) exceeded surface water quality criteria (87 ppb, 1,000 ppb, and 1.71 ppb, respectively) at location 2501. Aluminum also exceeded criteria at location 2503 (221 ppb). One VOC, methylene chloride, a common laboratory contaminant, was detected at sample location 2503 (1,700 ppb) above its surface water quality criteria (1,580 ppm). Note that the SVOC results for 2501 were rejected. No SVOCs or pesticides were detected in surface water.

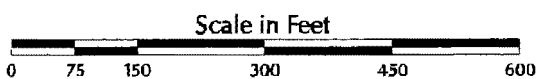
Table 10-26-3 shows the Wetland 25 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-26-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section. Constituents detected that do not have water quality criteria were not included in Table 10-26-4.



## Bayou Grande



- Sediment Sample Location
- Surface Water Sample Collected
- Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-26-1  
PHASE IIA WETLAND 25  
SAMPLING LOCATIONS**

Table 10-26-1  
 Phase IIA Detected Concentrations in Wetland 25 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	4180 - 12500	8486.67
Arsenic (As)	3/3	1.1 - 8.8	5.97
Barium (Ba)	3/3	2.3 - 8.6	5.5
Beryllium (Be)	2/3	0.47 - 0.59	0.53
Cadmium (Cd)	1/3	1.3	1.3
Calcium (Ca)	3/3	1770 - 17900	7790
Chromium (Cr)	3/3	7.1 - 59.1	33.07
Cobalt (Co)	3/3	1.6 - 2	1.83
Copper (Cu)	3/3	6.1 - 19.6	12.63
Iron (Fe)	3/3	1780 - 18500	11260
Lead (Pb)	3/3	21.4 - 58.7	37.4
Magnesium (Mg)	3/3	1420 - 6660	4523.33
Manganese (Mn)	3/3	2.6 - 66	33.1
Nickel (Ni)	2/3	6.5 - 6.9	6.7
Potassium (K)	3/3	172 - 2060	1220.67
Selenium (Se)	1/3	1.9	1.9
Sodium (Na)	3/3	640 - 24700	15913.33
Vanadium (V)	3/3	10.1 - 33.7	22.2
Zinc (Zn)	3/3	7.3 - 57.1	28.7
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDE	2/3	1.3 - 2	1.65
4,4'-DDT	1/3	1.8	1.8
Aldrin	2/3	0.28 - 1.4	0.84
Aroclor-1254	3/3	4.3 - 17	10.77
Endrin	2/3	0.84 - 1.9	1.37
alpha-BHC	1/3	0.67	0.67
alpha-Chlordane	2/3	0.56 - 0.88	0.72
gamma-BHC (Lindane)	1/3	1.3	1.3
<b>SVOCs (µg/kg)</b>			
Benzo(b)fluoranthene	1/2	59	59
<b>VOCs (µg/kg)</b>			
Acetone	1/3	940	940
Tetrachloroethene	1/3	23	23

**Note:**

All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).



**Table 10-26-2 (1)**  
**Wetland 25**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M250101</b>					
	4,4'-DDT (UG/KG)	1.8	1.19	1.51	b
	Aroclor-1254 (UG/KG)	17	21.6	0.79	b
	Arsenic (MG/KG)	1.1	7.24	0.15	a b
	Chromium (MG/KG)	7.1	52.3	0.14	a b
	Copper (MG/KG)	6.1	18.7	0.33	a b
	Lead (MG/KG)	21.4	30.2	0.71	a b
	Zinc (MG/KG)	7.3	124	0.06	a b
<b>041M250301</b>					
	4,4'-DDE (UG/KG)	1.3	2.07	0.63	b
	alpha-Chlordane (UG/KG)	0.56	1.7	0.33	a
	Aroclor-1254 (UG/KG)	4.3	21.6	0.20	b
	Arsenic (MG/KG)	9.8	7.24	1.22	a b
	Cadmium (MG/KG)	1.3	0.68	1.91	b
	Chromium (MG/KG)	59.1	52.3	1.13	a b
	Copper (MG/KG)	19.6	18.7	1.05	a b
	Endrin (UG/KG)	0.84	3.3	0.25	a
	gamma-BHC (Lindane) (UG/KG)	1.3	0.32	4.06	b
	Lead (MG/KG)	88.7	30.2	1.94	a b
	Nickel (MG/KG)	6.5	15.9	0.41	a b
	Zinc (MG/KG)	57.1	124	0.46	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

**Table 10-26-3**  
**Phase IIA Detected Concentrations in Wetland 25 Surface Water**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (µg/L)</b>			
Aluminum (Al)	2/2	221 - 1820	1020.5
Arsenic (As)	1/2	2.4	2.4
Calcium (Ca)	2/2	4620 - 6720	5670
Iron (Fe)	2/2	317 - 4030	2173.5
Lead (Pb)	1/2	4.9	4.9
Magnesium (Mg)	2/2	12500 - 20400	16450
Manganese (Mn)	2/2	2.9 - 4.2	3.55
Potassium (K)	2/2	3980 - 7060	5520
Sodium (Na)	2/2	105000 - 185000	145000
Thallium (Tl)	1/2	3.9	3.9
Vanadium (V)	1/2	6.4	6.4
<b>VOCs (µg/L)</b>			
Methylene chloride	1/2	1700	1700

*Note:*

All results are in micrograms per liter (µg/L) or parts per billion (ppb).

### 10.26.3 Fate and Transport

No pathways were evaluated for the wetland specific fate and transport for reference Wetland 25.

### 10.26.4 Ecological Risk Assessment

HQs for Wetland 25 sediment samples are presented in Table 10-26-2. Phase IIA sediment sample results compared to sediment benchmark levels revealed HQs above 1 for the pesticide 4,4'-DDT at sample location 2501 (1.51). However, as noted in the nature and extent discussion, this 4,4'-DDT concentration was below basewide levels. HQs were also greater than 1 for the metals arsenic (1.10), and lead (1.06) at sample location 2502. At sample location 2503, HQs were above 1 for the metals arsenic (1.22), cadmium (1.91), chromium (1.13), copper (1.05), and lead (1.94), as well as the pesticide gamma-BHC (4.06). Phase IIA surface water results revealed HQs above 1 for aluminum (20.92), iron (4.03), and lead (2.87) at sample location 2501. HQs were also above 1 for aluminum (2.54) and the VOC methylene chloride (1.08) at sample location 2503 (methylene chloride is a common laboratory contaminant). HQs greater than one indicate the potential for excess risk.

Table 10-26-4 (1)

## Wetland 25

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W250301	Freshwater	mg/L	1.000.0	0.1.0	0.0000	a
			0.0	0.0.0	0.0000	a
			1.000.0	1.000.0	0.0000	a
			0.0	0.0.0	0.0000	a
			0.0	0.0	0.0000	a
041W250301	Freshwater					
Aluminum		UG/L	221.0	87.0	2.54023	a
Iron		UG/L	317.0	1,000.0	0.317	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Wetland 25 is identified as a reference wetland (E/A&H, 1995a). Contaminants detected in reference wetlands were isolated and were generally below screening or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, Wetland 25 was considered to be a suitable reference wetland.

### **10.26.5 Wetland 25 Human Health Risk Assessment**

#### **10.26.5.1 Samples Included**

##### **Sediment**

041M250101, 041M250201, 041M250301

##### **Surface Water**

041W250101, 041W250301

#### **10.26.5.2 Current and Future Land Use**

Wetland 25 is located on the shore of Bayou Grande, north of Forrest Sherman Field. This area serves as part of an undeveloped buffer around the airfield. The wetland lies in an undeveloped portion of the base, accessible by dirt roads. However, access to these roads is restricted to the general public. Due to the lack of nearby infrastructure, it is unlikely that buildings or other development will be established in the near future. Access to the shoreline near the wetland could be made by boat.

#### **10.26.5.3 Fish Tissue COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.26.5.4 Sediment COPCs Identified**

As shown in Table 10-26-5, no COPCs were identified.

TABLE 10-26-5  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeline: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wellbore 25 Sediment

CAS Number	Chemical	(1)		(1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2)		(3)	(4)	(5)		Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection
		Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier						Concentration Used for Screening	Background Value	Adolescent Site Trespasser prg	Commercial Maintenance Worker Screening Toxicity Value					
72559	4,4'-DDE	1.3000	J	2.0000	J	UG/KG	041M250201	2 / 3	1.70 - 1.70	1.65	2.00	N/A	65000	1900	C	N/A	NO	BSL	
50293	4,4'-DDT	1.8000	J	1.8000	J	UG/KG	041M250101	1 / 3	0.53 - 1.20	1.80	1.80	N/A	65000	1900	C	N/A	NO	BSL	
309002	Aldrin	0.2800	J	1.4000	J	UG/KG	041M250201	2 / 3	0.82 - 0.82	0.84	1.40	N/A	1300	38	C	N/A	NO	BSL	
11097691	Aroclor-1254	4.3000	J	17.0000	J	UG/KG	041M250101	3 / 3	NAV	10.77	17.00	N/A	6300	160	N	N/A	NO	BSL	
72208	Endrin	0.8400	J	1.9000	J	UG/KG	041M250201	2 / 3	1.70 - 1.70	1.37	1.90	N/A	95000	2300	N	N/A	NO	BSL	
319846	alpha-BHC	0.6700	J	0.6700	J	UG/KG	041M250301	1 / 3	0.59 - 0.82	0.67	0.67	N/A	3500	100	C	N/A	NO	BSL	
5103719	alpha-Chlordane	0.5600	J	0.8800	J	UG/KG	041M250201	2 / 3	0.82 - 0.82	0.72	0.88	N/A	63000	1800	C	N/A	NO	BSL	
58899	gamma-BHC	1.3000	J	1.3000	J	UG/KG	041M250301	1 / 3	0.59 - 0.82	1.30	1.30	N/A	17000	490	C	N/A	NO	BSL	
205992	Benzo(b)fluoranthene	59.0000	J	59.0000	J	UG/KG	041M250301	1 / 2	230.00 - 230.00	59.00	59.00	N/A	30000	880	C	N/A	NO	BSL	
127184	Tetrachloroethene	23.0000	J	23.0000	J	UG/KG	041M250101	1 / 3	59.00 - 77.00	23.00	23.00	N/A	430000	12000	C	N/A	NO	BSL	
67641	Acetone	940.0000	J	940.0000	J	UG/KG	041M250301	1 / 2	77.00 - 110.00	940.00	940.00	N/A	32000000	780000	N	N/A	NO	BSL	
7440382	Arsenic (As)	1.1000		8.8000		MG/KG	041M250301	3 / 3	NAV	5.97	8.80	N/A	15	0.43	C	N/A	NO	BSL	
7440439	Cadmium (Cd)	1.3000		1.3000		MG/KG	041M250301	1 / 3	1.00 - 1.40	1.30	1.30	N/A	320	7.8	N	N/A	NO	BSL	
7440484	Cobalt	1.6000		2.0000		MG/KG	041M250301	3 / 3	NAV	1.83	2.00	N/A	19000	470	N	N/A	NO	BSL	
7440508	Copper (Cu)	6.1000		19.6000		MG/KG	041M250301	3 / 3	NAV	12.63	19.60	N/A	13000	310	N	N/A	NO	BSL	
7440020	Nickel (Ni)	6.5000		6.9000		MG/KG	041M250201	2 / 3	5.50 - 5.50	6.70	6.90	N/A	6300	160	N	N/A	NO	BSL	
7440097	Potassium (K)	172.0000		2060.0000		MG/KG	041M250301	3 / 3	NAV	1220.67	2060.00	N/A	N/A	N/A	N/A	NO	NTX		
7782492	Selenium (Se)	1.9000		1.9000		MG/KG	041M250201	1 / 3	1.20 - 1.40	1.90	1.90	N/A	1600	39	N	N/A	NO	BSL	
7429905	Aluminum (Al)	4180.0000		12500.0000		MG/KG	041M250301	3 / 3	NAV	8486.67	12500.00	N/A	320000	7800	N	N/A	NO	BSL	
7440393	Barium (Ba)	2.3000		8.6000		MG/KG	041M250301	3 / 3	NAV	5.50	8.60	N/A	22000	550	N	N/A	NO	BSL	
7440417	Beryllium	0.4700		0.5900		MG/KG	041M250301	2 / 3	NAV	0.53	0.59	N/A	530	16	N	N/A	NO	BSL	
7440702	Calcium (Ca)	1770.0000		17900.0000		MG/KG	041M250301	3 / 3	NAV	7790.00	17900.00	N/A	N/A	N/A	N/A	NO	NTX		
7440473	Chromium (Cr)	7.1000		59.1000		MG/KG	041M250301	3 / 3	NAV	33.07	59.10	N/A	1600	23	N	N/A	NO	BSL	
7439896	Iron (Fe)	1780.0000		18500.0000		MG/KG	041M250301	3 / 3	NAV	11206.00	18500.00	N/A	N/A	N/A	N/A	NO	NTX		
7439921	Lead (Pb)	21.4000		58.7000		MG/KG	041M250301	3 / 3	NAV	37.40	58.70	N/A	400	400	OSWER	N/A	NO	BSL	
7439954	Magnesium (Mg)	1420.0000		6660.0000		MG/KG	041M250301	3 / 3	NAV	4523.33	6660.00	N/A	N/A	N/A	N/A	NO	NTX		
7439965	Manganese (Mn)	2.6000		66.0000		MG/KG	041M250301	3 / 3	NAV	33.10	66.00	N/A	15000	1100	N	N/A	NO	BSL	
7440235	Sodium (Na)	640.0000		24700.0000		MG/KG	041M250301	3 / 3	NAV	15913.33	24700.00	N/A	N/A	N/A	N/A	NO	NTX		
7440622	Vanadium (V)	10.1000		33.7000		MG/KG	041M250301	3 / 3	NAV	22.20	33.70	N/A	2200	55	N	N/A	NO	BSL	
7440666	Zinc (Zn)	7.3000		57.1000		MG/KG	041M250301	3 / 3	NAV	28.70	57.10	N/A	95000	2300	N	N/A	NO	BSL	

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGee for trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(5) Residential soil RBC as presented in USEPA Region III RBC Tables, 1998.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Definitions: NAV = Not Available

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.26.5.5 Surface Water COPCs Identified**

As shown in Table 10-26-6, the following COPCs were identified:

- Methylene chloride

#### **10.26.5.6 Risk Characterization**

Tables 10-26-7 and 10-26-8 summarize cancer risk estimates for the surface water pathways. Methylene chloride was the only contributor to risk estimates for the surface water pathways. The cumulative risk estimated for this wetland is  $1.6\text{E-}6$ . The HI shown in Table 10-26-8 was estimated to be 0.02. Methylene chloride was identified as a COC in surface water based on its contribution to cumulative risk estimates for this wetland.

#### **10.26.5.7 Remedial Goal Options**

RGOs were developed in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 5, Remedial Options* (USEPA, 1996a). Methylene chloride was the only COC identified at this wetland and was identified as a COC for surface water only. Because methylene chloride was identified as a COC for surface water based only on cancer risk estimates and not based on hazard index estimates, only risk based RGOs were developed. The maximum methylene concentration of 1.7 mg/L in surface water resulted in a risk estimate of  $1.6\text{E-}6$ , as shown in Table 10-26-8. Using a linear ratio, 1.0 mg/L would correspond with a target risk of  $1\text{E-}6$ . Therefore, 10 mg/L and 100 mg/L represent target risks of  $1\text{E-}5$  and  $1\text{E-}4$ , respectively.

#### **10.26.6 Conclusions and Recommendations**

Wetland 25 is identified as a reference wetland (E/A&H, 1995a), where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. Therefore, Wetland 25 was not studied further in Phase IIB/III.

The HHRA identified no sediment or fish tissue COPCs. Methylene chloride was identified as a COC in surface water based on its contribution to cumulative risk estimates for this wetland.

**TABLE 10-26-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 25 Surface Water

		(1)		(1)					(2)		(3)	(4)			(5)
CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Detection Frequency	Mean	Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection
7429905	Aluminum (Al)	221		1820		UG/L	2 / 2	1020.5	1820	N/A	120000	3700	N	N/A	BSL
7440382	Arsenic	2.4		2.4		UG/L	1 / 2	2.4	2.4	N/A	5.6	0.045	C	N/A	BSL
7440702	Calcium (Ca)	4620		6720		UG/L	2 / 2	5670	6720	N/A	N/A	N/A		N/A	EN
7439896	Iron (Fe)	317		4030		UG/L	2 / 2	2173.5	4030	N/A	N/A	N/A		N/A	EN
7439921	Lead (Pb)	4.9		4.9		UG/L	1 / 2	4.9	4.9	N/A	15	15		TTAL	BSL
7439954	Magnesium (Mg)	12500		20400		UG/L	2 / 2	16450	20400	N/A	N/A	N/A		N/A	EN
7439965	Manganese (Mn)	2.9		4.2		UG/L	2 / 2	3.55	4.2	N/A	2400	73	N	N/A	BSL
7440097	Potassium (K)	3980		7060		UG/L	2 / 2	5520	7060	N/A	N/A	N/A		N/A	EN
7440235	Sodium	105000		185000		UG/L	2 / 2	145000	185000	N/A	N/A	N/A		N/A	EN
7440280	Thallium	3.9		3.9		UG/L	1 / 2	3.9	3.9	N/A	8.3	0.26	N	N/A	BSL
7440622	Vanadium (V)	6.4		6.4		UG/L	1 / 2	6.4	6.4	N/A	830	1800	N	N/A	BSL
75092	Methylene chloride	1700		1700		UG/L	1 / 2	1700	1700	N/A	1000	4.1	C	N/A	ASL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(8) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment Technique Action Level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-26-7  
CALCULATION OF CANCER RISKS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future Medium: Surface water Exposure Medium: Surface water Exposure Point: Wetland 25 Receptor Population: Trespasser Receptor Age: Adolescent
---

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Slope Factor Units	Cancer Risk
Ingestion	Methylene chloride	1.7	MG/L	N/A	M	1.00E-04	mg/kg-day	0.0075	(mg/kg-day) <sup>-1</sup>	7.50E-07
Dermal	Methylene chloride	1.7	MG/L	N/A	M	9.35E-05	mg/kg-day	0.009375	(mg/kg-day) <sup>-1</sup>	8.77E-07
Total Risk										1.63E-06

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.



TABLE 10-26-8  
RME CALCULATION OF NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 25  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Hazard Quotient
Ingestion	Methylene chloride	1.7	MG/L	N/A	M	7.00E-04	mg/kg-day	6.00E-02	mg/kg-day	0.0117
Dermal	Methylene chloride	1.7	MG/L		M	6.04E-04	mg/kg-day	4.80E-02	mg/kg-day	0.0126
<b>Total Hazard Index</b>										<b>0.02</b>

EPC = Exposure Point Concentration

MG/L = Milligram per Liter

M = Medium-specific EPC selected for risk calculation.

Under a cumulative risk scenario for methylene chloride in surface water, an EPC of 1.7 mg/L resulted in a risk estimate of 1.6E-6. Linear ratio analyses reveal that a target risk of 1E-6 results from an EPC of 1.0 mg/L, with EPCs of 10 mg/L and 100 mg/L representing target risks of 1E-5 and 1E-4, respectively.

Methylene chloride is a common laboratory contaminant. Also, Wetland 25 is located in a remote portion of the base that has restricted access, and the wetland has no value for recreational fishing or swimming. These factors, combined with the limited ecological risk at Wetland 25 support the use of Wetland 25 as a reference wetland.

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## **10.27 WETLAND 27**

### **10.27.1 Site Description**

Wetland 27 is along NAS Pensacola shoreline of Bayou Grande, east of Wetlands 25, 66, and 67. Parsons and Pruitt (USEPA, 1991) divided this site into two distinctive parts, Wetlands 27A and 27B. Wetland 27A is described as an inland palustrine system, whereas Wetland 27B is an estuarine emergent wetland, seaward of Wetland 27A. Wetland 27A contains sweetbay magnolia (*Magnolia virginiana*) and black titi (*Cliftonia monophylla*). There is no prominent surface water drainage into this area. Wetland 27B is tidally influenced from Bayou Grande and maintains a thick growth of black needlerush (*Juncus roemerianus*). No IR sites exist in the vicinity of Wetland 27.

### **10.27.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-27-1 denotes the Phase IIA Wetland 27 sampling locations.

#### **Sediment**

Seventeen metals were detected in Wetland 27 sediment samples. No metals exceeded sediment benchmark levels at Wetland 27. Four pesticides were detected at Wetland 27, including 4,4-DDE, 4,4'-DDT, alpha-BHC, and alpha-chlordane. Although 4,4'-DDE (2.7 ppb; sample 2701) and 4,4'-DDT (1.9 ppb; sample 2702) concentrations exceeded benchmark levels, they were below basewide levels. Basewide levels are described in Section 6. The other pesticides were below benchmark levels. No PCBs were detected in Wetland 27 sediment samples. The SVOC diethylphthalate was detected below sediment criteria. No VOCs were detected in Wetland 27 sediment samples. Table 10-27-1 shows the Wetland 27 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration).

Final Remedial Investigation Report  
 NAS Pensacola Site 4I  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-27-1  
 Phase IIA Detected Concentrations in Wetland 27 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum	2/2	2900 - 3670	3285
Arsenic	2/2	0.98 - 1.1	1.04
Barium	2/2	213 - 311	277
Calcium	2/2	941 - 1260	1100.5
Chromium	2/2	11.1 - 12.4	11.75
Cobalt	2/2	0.46 - 0.51	0.485
Copper	2/2	3.4 - 4.2	3.8
Iron	2/2	1380 - 1440	1410
Lead	2/2	13.2 - 13.5	13.35
Magnesium	2/2	1200 - 2070	1635
Manganese	2/2	5.1	5.1
Nickel	2/2	2-3	2.5
Potassium	2/2	406 - 689	547.5
Selenium	1/2	0.39	0.39
Sodium	2/2	3170 - 8610	5890
Vanadium	2/2	5.2 - 6.9	6.05
Zinc	2/2	4.7 - 8.2	6.45
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDE	2/2	1.8 - 2.7	2.25
4,4'-DDT	1/2	1.9	1.9
alpha-BHC	2/2	0.49 - 1.3	0.895
alpha-Chlordane	1/2	0.49	0.49
<b>SVOCs (µg/kg)</b>			
Diethylphthalate	1/2	390	390

**Note:**

All results for inorganics are given in milligrams per kilogram (mg/kg), pesticides, PCBs, and SVOCs are given in micrograms per kilograms (µg/kg)

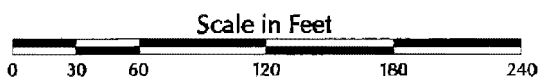
Table 10-27-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters with benchmark levels are presented on Table 10-27-2. The HQs will be further discussed in the ecological risk section.



## Bayou Grande



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

**FIGURE 10-27-1  
PHASE IIA WETLAND 27  
SAMPLING LOCATIONS**

**Table 10-27-2**  
**Wetland 27**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV Reference
041M270201					
	4,4'-DDE (UG/KG)	1.8 J	2.07	0.87	b
	4,4'-DDT (UG/KG)	1.9 J	1.19	1.60	b
	Arsenic (MG/KG)	0.98 J	7.24	0.14	a b
	Chromium (MG/KG)	12.4	52.3	0.24	a b
	Copper (MG/KG)	3.4 J	18.7	0.18	a b
	Lead (MG/KG)	13.2 J	30.2	0.44	a b
	Nickel (MG/KG)	3 J	15.9	0.19	a b
	Zinc (MG/KG)	4.7 J	124	0.04	a b

**041M270201**

4,4'-DDE (UG/KG)	1.8 J	2.07	0.87	b
4,4'-DDT (UG/KG)	1.9 J	1.19	1.60	b
Arsenic (MG/KG)	0.98 J	7.24	0.14	a b
Chromium (MG/KG)	12.4	52.3	0.24	a b
Copper (MG/KG)	3.4 J	18.7	0.18	a b
Lead (MG/KG)	13.2 J	30.2	0.44	a b
Nickel (MG/KG)	3 J	15.9	0.19	a b
Zinc (MG/KG)	4.7 J	124	0.04	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.  
 Basewide levels (detailed in Section 6) for DDT and its metabolites:  
 Basewide level for 4,4'-DDE is 40 ppb.  
 Basewide level for 4,4'-DDD is 50 ppb.  
 Basewide level for 4,4'-DDT is 20 ppb.

## Surface Water

Thirteen metals were detected in the single Wetland 27 surface water sample. Aluminum (5,500 ppb), copper (9.2 ppb), iron (2,230 ppb), lead (25.9 ppb), and mercury (0.17 ppb) exceeded surface water quality criteria at Wetland 27. This sample was highly turbid because the surface water was only 3 inches deep. No organics were detected in Wetland 27 surface water.

Table 10-27-3 shows the Wetland 27 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-27-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-27-4. The HQs will be further discussed in the ecological risk section.

Table 10-27-3  
 Phase IIA Detected Concentrations in Wetland 27 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum	1/1	5550	5550
Arsenic	1/1	4.1	4.1
Calcium	1/1	99000	99000
Chromium	1/1	13.3	13.3
Copper	1/1	9.2	9.2
Iron	1/1	2230	2230
Lead	1/1	25.9	25.9
Magnesium	1/1	327000	327000
Mercury	1/1	0.17	0.17
Potassium	1/1	106000	106000
Sodium	1/1	2580000	2580000
Vanadium	1/1	11	11
Zinc	1/1	19.6	19.6

Note:  
 All results are given in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).



Table 10-27-4 (1)

## Wetland 27

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W270201</b>	<b>Saltwater</b>					
	Aluminum	UG/L	5,550.0	1,500.0	3.7	b
	Arsenic	UG/L	4.1	36.0	0.11389	a
	Chromium	UG/L	13.3	50.0	0.266	a b
	Copper	UG/L	9.2	2.9	3.17241	a b
	Iron	UG/L	2,230.0	300.0	7.43333	b
	Lead	UG/L	25.9	5.6	4.625	b
	Mercury	UG/L	0.17	0.025	6.8	a b
	Zinc	UG/L	19.6	86.0	0.22791	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### **10.27.3 Fate and Transport**

No pathways were evaluated for the wetland specific fate and transport for reference Wetland 27.

### **10.27.4 Ecological Risk Assessment**

HQs for Wetland 27 sediment samples are presented in Table 10-27-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for 4,4'-DDE (1.30) at sample location 2701 and 4,4'-DDT at sample location 2702 (1.60). However, as noted in the nature and extent discussion, these 4,4'-DDE and 4,4'-DDT concentrations were below basewide levels. Phase IIA results of the single Wetland 27 surface water sample revealed HQs above 1 for aluminum (3.70), copper (3.17), iron (7.43), lead (4.63), and mercury (6.80). HQs greater than one indicate the potential for excess risk.

Wetland 27 is identified as a reference wetland (E/A&H. 1995a). Contaminants detected in reference wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. The concentrations detected inorganic are compared to detected concentrations in other wetlands to assess whether the concentrations are naturally-occurring or man-induced. Reference concentrations are described in Section 6.

### **10.27.5 Wetland 27 Human Health Risk Assessment**

#### **10.27.5.1 Samples Included**

##### **Sediment**

041M270101, 041M270201

##### **Surface Water**

041W270201

#### **10.27.5.2 Current and Future Land Use**

Wetland 27 is on the shore of Bayou Grande, north of Forrest Sherman Field. This area serves as part of an undeveloped buffer around the airfield. The wetland lies in an undeveloped portion of the base, accessible by dirt roads. However, access to these roads is restricted to the general public. Due to the lack of nearby infrastructure, it is unlikely that buildings or other development will be established in the near future. Access to the shoreline near the wetland could be made by boat.

#### **10.27.5.3 Fish Tissue COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.27.5.4 Sediment COPCs Identified**

As shown in Table 10-27-5, no COPCs were identified.

#### **10.27.5.5 Surface Water COPCs Identified**

As shown in Table 10-27-6, the following COPCs were identified:

- Lead

#### **10.27.5.6 Risk Characterization**

##### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of the surface water concentration of lead at Wetland 27. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for a year. Exposure to Wetland 27 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's home. This additional exposure was presented as an "alternate" source within the constructs of

TABLE 10-27-5  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 27 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
72559	4,4'-DDE	1.8000		2.7000		UG/KG		2 / 2	NAV	2.25	2.70	N/A	65000	1900	C	N/A	BSL
50293	4,4'-DDT	1.9000		1.9000		UG/KG		1 / 2	-	1.90	1.90	N/A	65000	1900	C	N/A	BSL
319846	alpha-BHC	0.4900		1.3000		UG/KG		2 / 2	NAV	0.90	1.30	N/A	3500	100	C	N/A	BSL
5103719	alpha-Chlordane	0.4900		0.4900		UG/KG		1 / 2	-	0.49	0.49	N/A	63000	1800	C	N/A	BSL
84662	Diethylphthalate	390.0000		390.0000		UG/KG		1 / 2	-	390.00	390.00	N/A	250000000	63000000	N	N/A	BSL
7429905	Aluminum (Al)	2900.0000		3670.0000		MG/KG		2 / 2	NAV	3285.00	3670.00	N/A	320000	7800	N	N/A	BSL
7440382	Arsenic (As)	0.9800		1.1000		MG/KG		2 / 2	NAV	1.04	1.10	N/A	15	0.43	C	N/A	BSL
7440393	Barium (Ba)	2.3000		3.1000		MG/KG		2 / 2	NAV	2.70	3.10	N/A	22000	550	N	N/A	BSL
7440702	Calcium (Ca)	941.0000		1260.0000		MG/KG		2 / 2	NAV	1100.50	1260.00	N/A	N/A	N/A	N	N/A	NTX
7440473	Chromium (Cr)	11.1000		12.4000		MG/KG		2 / 2	NAV	11.75	12.40	N/A	1600	23	N	N/A	BSL
7440484	Cobalt	0.4600		0.5100		MG/KG		2 / 2	NAV	0.49	0.51	N/A	19000	470	N	N/A	BSL
7440508	Copper (Cu)	3.4000		4.2000		MG/KG		2 / 2	NAV	3.80	4.20	N/A	13000	310	N	N/A	BSL
7439896	Iron (Fe)	1380.0000		1440.0000		MG/KG		2 / 2	NAV	1410.00	1440.00	N/A	N/A	N/A	N	N/A	NTX
7439921	Lead (Pb)	13.2000		13.5000		MG/KG		2 / 2	NAV	13.35	13.50	N/A	400	400		OSWER	BSL
7439954	Magnesium (Mg)	1200.0000		2070.0000		MG/KG		2 / 2	NAV	1635.00	2070.00	N/A	N/A	N/A	N	N/A	NTX
7439965	Manganese (Mn)	5.1000		5.1000		MG/KG		2 / 2	NAV	5.10	5.10	N/A	15000	1100	N	N/A	BSL
7440020	Nickel (Ni)	2.0000		3.0000		MG/KG		2 / 2	NAV	2.50	3.00	N/A	6300	160	N	N/A	BSL
7440097	Potassium (K)	406.0000		689.0000		MG/KG		2 / 2	NAV	547.50	689.00	N/A	N/A	N/A	N	N/A	NTX
7782492	Selenium (Se)	0.3900		0.3900		MG/KG		1 / 2	-	0.39	0.39	N/A	1600	39	N	N/A	BSL
7440235	Sodium (Na)	3170.0000		8610.0000		MG/KG		2 / 2	NAV	5890.00	8610.00	N/A	N/A	N/A	N	N/A	NTX
7440622	Vanadium (V)	5.2000		6.9000		MG/KG		2 / 2	NAV	6.05	6.90	N/A	2200	55	N	N/A	BSL
7440666	Zinc (Zn)	4.7000		8.2000		MG/KG		2 / 2	NAV	6.45	8.20	N/A	95000	2300	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(5) Residential soil RBC as presented in USEPA Region III RBC Tables, 1998.

(6) Rationale Codes  
Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)

Definitions:

NAV = Not Available

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

**TABLE 10-27-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 27 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Detection Frequency	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
7429905	Aluminum (Al)	5550		5550		UG/L	1 / 1	5550	5550	N/A	120000	3700	N	N/A	BSL
7440382	Arsenic	4.1		4.1		UG/L	1 / 1	4.1	4.1	N/A	5.6	0.045	C	N/A	BSL
7440702	Calcium (Ca)	99000		99000		UG/L	1 / 1	99000	99000	N/A	N/A	N/A		N/A	EN
7440473	Chromium (Cr)	13.3		13.3		UG/L	1 / 1	13.3	13.3	N/A	360	11	N	N/A	BSL
7440508	Copper (Cu)	9.2		9.2		UG/L	1 / 1	9.2	9.2	N/A	4800	150	N	N/A	BSL
7439896	Iron (Fe)	2230		2230		UG/L	1 / 1	2230	2230	N/A	N/A	N/A		N/A	EN
7439921	Lead (Pb)	25.9		25.9		UG/L	1 / 1	25.9	25.9	N/A	15	15		TTAL	ASL
7439954	Magnesium (Mg)	327000		327000		UG/L	1 / 1	327000	327000	N/A	N/A	N/A		N/A	EN
7439976	Mercury (Hg)	0.17		0.17		UG/L	1 / 1	0.17	0.17	N/A	36	1.1	N	N/A	BSL
7440097	Potassium (K)	106000		106000		UG/L	1 / 1	106000	106000	N/A	N/A	N/A		N/A	EN
7440235	Sodium	2580000		2580000		UG/L	1 / 1	2580000	2580000	N/A	N/A	N/A		N/A	EN
7440622	Vanadium (V)	11		11		UG/L	1 / 1	11	11	N/A	830	1800	N	N/A	BSL
7440666	Zinc (Zn)	19.6		19.6		UG/L	1 / 1	19.6	19.6	N/A	36000	1100	N	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Tap water RBCs as presented in USEPA Region III RBC Tables (1998).

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment Technique Action Level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

the Lead Model. The standard default assumptions in the Lead Model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland 27.

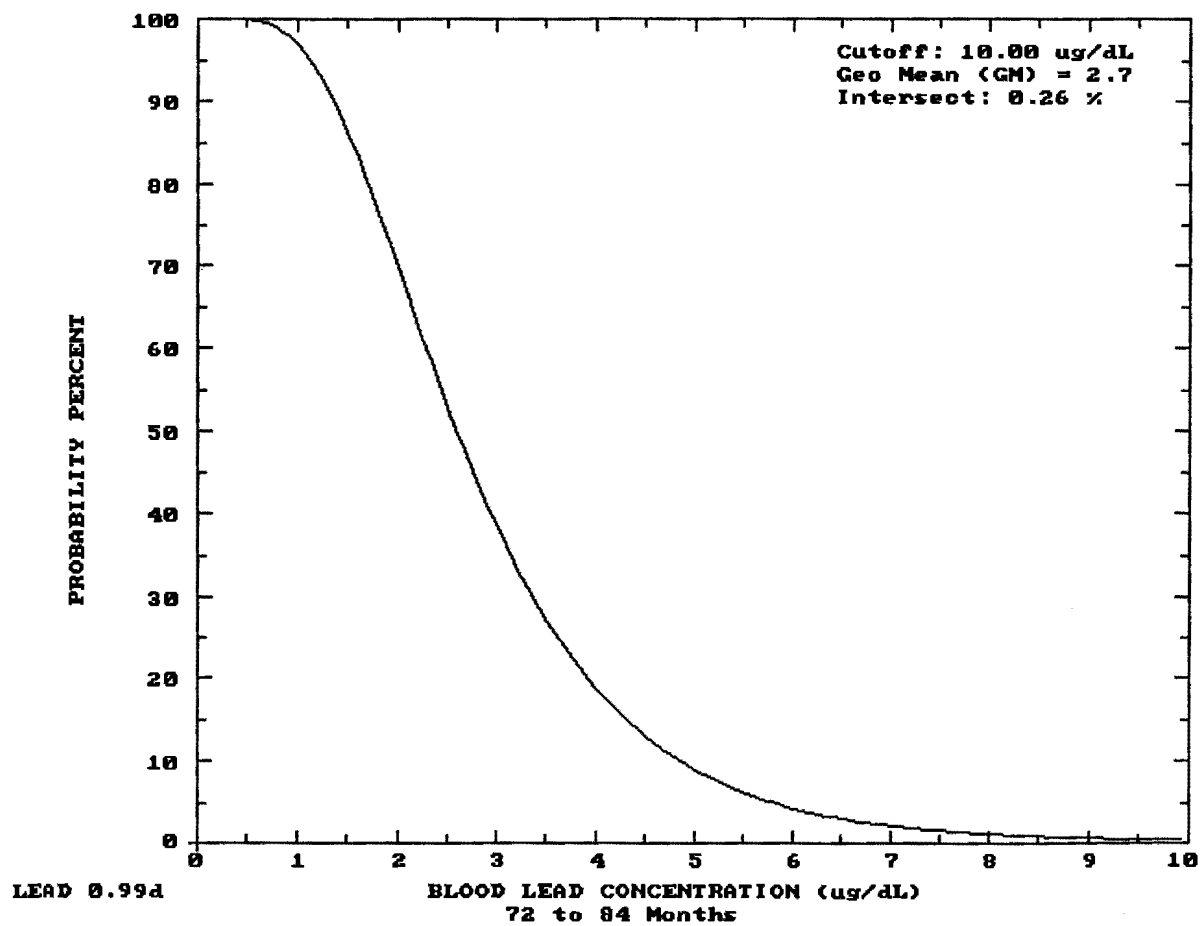
The assumption was made that this child would incidentally ingest 0.05 liters of surface water during each visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland 27 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 0.05 liters of surface water once per week with a lead concentration of  $25.9 \mu\text{g/L}$ , the annual alternate source exposure was estimated to be  $0.18 \mu\text{g lead/day}$ . Table 10-27-7 presents the Lead Model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-27-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be  $2.7 \mu\text{g/dL}$ , and the probability of blood lead levels in excess of  $10 \mu\text{g/dL}$  is 0.26%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, the surface water lead concentration at Wetland 27 would not require specific action under the hypothetical exposure scenario.

#### **10.27.5.7 Remedial Goal Options**

No COCs were identified for Wetland 27, and as a result, no RGOs were calculated.

Figure 10-27-2 Probability Plots for Blood Lead Levels Wetland 27



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Table 10-27-7  
 Lead Model (Version 0.99d) Inputs and Results  
 NAS Pensacola, Wetland 27  
 Pensacola, Florida

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT

Indoor AIR Pb Conc: 30.0 percent of outdoor.

Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT

WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.

Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

Alternative Source Intake: Wetland 27 surface water

6-7: 0.18  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model

Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil+Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	2.7	9.56	4.89	3.36	1.13	0.09	0.09

#### **10.27.6 Conclusions and Recommendations**

Wetland 27 is identified as a reference wetland (E/A&H, 1995a), where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. Therefore, Wetland 27 was not studied further in Phase IIB/III.

The HHRA identified no sediment or fish tissue COPCs. Lead was identified as a surface water COPC. Under USEPA guidelines, surface water lead concentrations at Wetland 27 would not require specific action under the hypothetical exposure scenario. Since no COCs were identified, no RGOs were calculated for Wetland 27.

Because no ecological or human health risks are present at Wetland 27, this wetland is acceptable as a reference wetland.

## **10.28 WETLAND 32**

### **10.28.1 Site Description**

Wetland 32 is upstream from Wetland 33 on Navy property adjacent to NAS Pensacola to the southwest. The area is also known as Trout Point. Parsons and Pruitt described this system as a palustrine emergent wetland (USEPA, 1991). A freshwater stream runs through Wetland 32, eventually draining into Wetland 33, which discharges to Big Lagoon. The stream originates to the northeast of Trout Point, near Wetland 53. Saw grass (*Cladium jamaicense*) is the predominant vegetation in Wetland 32.

In 1996, the Navy took steps to preserve the Trout Point area, which has been subject to minimal impact from surrounding development. The area around Wetland 32 was developed into a low impact recreational area, with a board walk and nature trail. No IR sites exist in the immediate vicinity of Wetland 32.

### **10.29.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-28-1 denotes the Phase IIA Wetland 32 sampling locations.

#### **Sediment**

Sixteen metals were detected in Wetland 32 sediment samples. Lead, ranging from 41.3 mg/kg to 52.3 mg/kg, exceeded the sediment benchmark level (30.2 mg/kg) in all three Wetland 32 sediment samples. Mercury (0.51 mg/kg) also exceeded the benchmark level (0.13 mg/kg) at sample location 3203. Ten pesticides were detected in Wetland 32 sediment samples, including 4,4'-DDT and its metabolites, dieldrin, endrin, endrin aldehyde, alpha/gamma-BHC, and alpha/gamma-chlordane. All detected concentrations of 4,4'-DDT and its metabolites were below basewide levels. Alpha-chlordane (12 ppb), gamma-chlordane (5.9 ppb), dieldrin (13 ppb), and endrin (15 ppb), and were detected above sediment benchmark levels (1.7 ppb for alpha and

gamma chlordane; 0.72 ppb and 3.3ppb for dieldrin and endrin, respectively) at sample location 3201. Endrin aldehyde (4.2 ppb), was detected above its sediment benchmark level (3.3 ppb) at sample location 3202. The PCB Aroclor-1254 (210 ppb) was detected above its sediment criteria (21.6 ppb) at sample location 3201. The SVOC, pyrene (170 ppb), was detected above its sediment criteria (153 ppb) at sample location 3203. Three VOCs, 2-butanone, acetone, and chlorobenzene were detected at Wetland 32. Acetone is a common laboratory contaminant.

Table 10-28-1 shows the Wetland 32 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-28-2 lists only the detected parameters with benchmark levels, compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.

### **Surface Water**

Six metals were detected in Wetland 32 surface water samples. No metals detections exceeded surface water quality criteria. The only organic detected in Wetland 32 surface water was the VOC methylene chloride, at a concentration below its criteria. Methylene chloride is also a common laboratory contaminant.

Table 10-28-3 shows the Wetland 32 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-28-4 lists only the detected parameters with water quality criteria, compares detected concentrations at each sample location to surface water quality criteria, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.

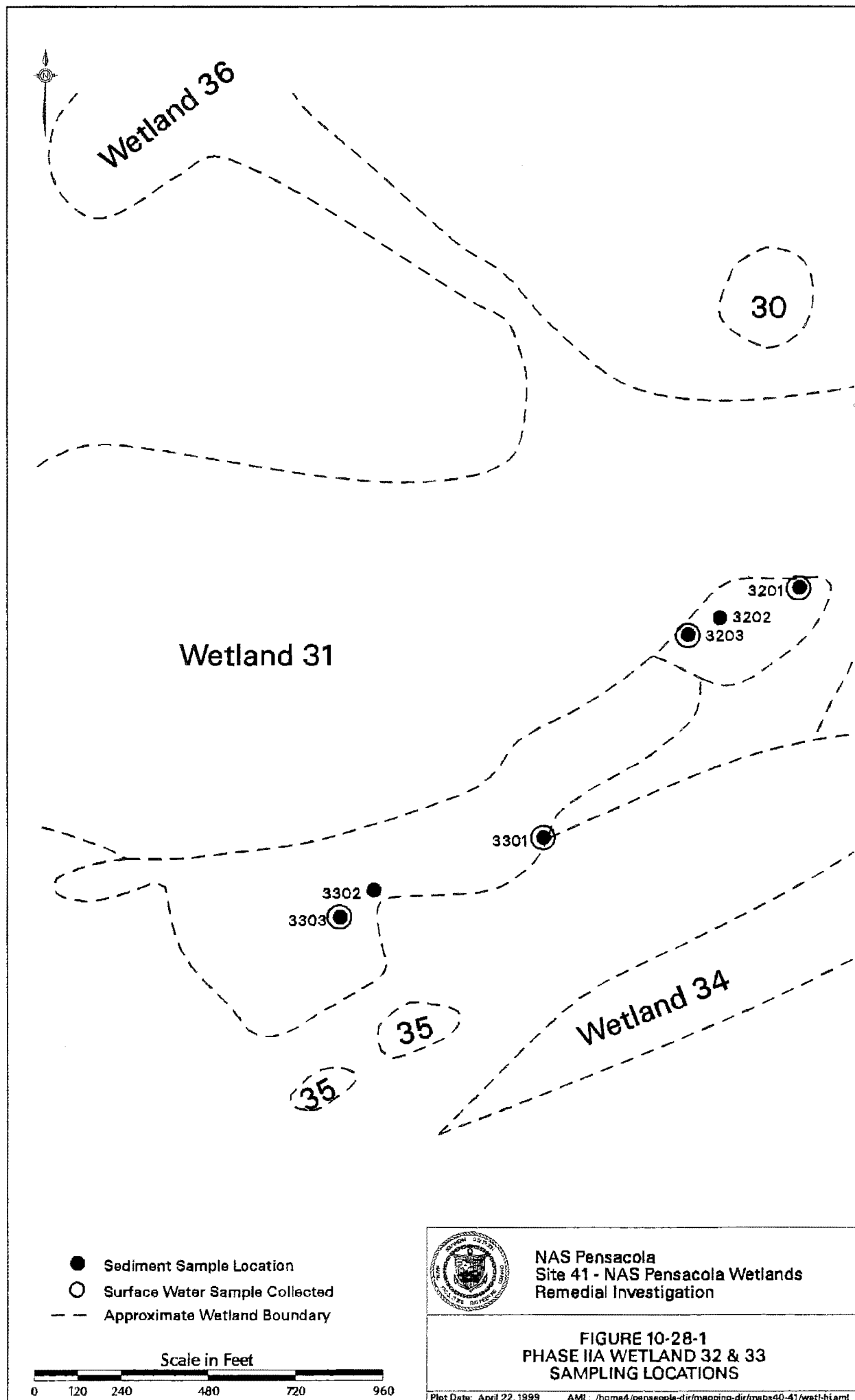


Table 10-28-1  
 Phase IIA Detected Concentrations in Wetland 32 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	3670 - 7780	5123.33
Barium (Ba)	3/3	6.7 - 9.7	8.50
Beryllium (Be)	1/3	0.51 - 0.51	0.51
Calcium (Ca)	3/3	2150 - 4320	2966.67
Chromium (Cr)	3/3	5.7 - 7.2	6.30
Copper (Cu)	3/3	5.7 - 9.2	6.87
Iron (Fe)	3/3	471 - 832	651.67
Lead (Pb)	3/3	41.3 - 52.3	45.07
Magnesium (Mg)	3/3	2230 - 4280	2990.00
Manganese (Mn)	3/3	3.5 - 5.6	4.87
Mercury (Hg)	1/3	0.51	0.51
Potassium (K)	3/3	306 - 485	408.00
Selenium (Se)	2/3	2.4 - 3.6	3.00
Sodium (Na)	3/3	2580 - 3680	3080.00
Vanadium (V)	3/3	5.2 - 7.6	6.47
Zinc (Zn)	3/3	6.8 - 9.4	8.03
<b>Pesticides/PCBs (µg/kg)</b>			
4,4'-DDD	2/3	3.3 - 24	13.65
4,4'-DDE	2/3	2.2 - 37	19.60
4,4'-DDT	1/3	13	13.00
Aroclor-1254	1/3	210	210.00
Dieldrin	1/3	13	13.00
Endrin	1/3	15	15.00
Endrin aldehyde	1/3	4.2	4.20
alpha-BHC	2/3	1.4 - 5.2	3.30
alpha-Chlordane	1/3	12	12.00
gamma-BHC (Lindane)	1/3	1.4	1.40
gamma-Chlordane	1/3	5.9	5.90
<b>Semivolatiles (µg/kg)</b>			
Pyrene	1/3	170	170.00
<b>Volatiles (µg/kg)</b>			
2-Butanone (MEK)	1/3	70	70.00
Acetone	2/3	930 - 1900	1415.00
Chlorobenzene	1/3	14	14.00

**Note:**

All results are in micrograms per kilogram (µg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

Table 10-28-2 (1)  
Wetland 32  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M320101</b>					
	4,4'-DDD (UG/KG)	24	1.22	19.67	b
	4,4'-DDE (UG/KG)	37	2.07	17.87	b
	4,4'-DDT (UG/KG)	13	1.19	10.92	b
	alpha-Chlordane (UG/KG)	12	1.7	7.06	a
	Aroclor-1254 (UG/KG)	210	21.6	9.72	b
	Chromium (MG/KG)	7.2	52.3	0.14	a b
	Copper (MG/KG)	5.7	18.7	0.30	a b
	Dieldrin (UG/KG)	13	0.72	18.09	b
	Endrin (UG/KG)	15	3.3	4.55	a
	gamma-Chlordane (UG/KG)	9.9	1.7	3.47	a
	Lead (MG/KG)	41.8	30.2	1.37	a b
	Zinc (MG/KG)	5.8	124	0.05	a b
<b>041M320102</b>					
	4,4'-DDD (UG/KG)	8.1	1.22	6.63	b
	4,4'-DDE (UG/KG)	8.1	2.07	3.96	b
	4,4'-DDT (UG/KG)	3.9	1.19	3.28	b
	Lead (MG/KG)	41.8	30.2	1.37	a b
	Zinc (MG/KG)	1.5	124	0.01	a b
<b>041M320301</b>					
	4,4'-DDD (UG/KG)	3.3	1.22	2.70	b
	4,4'-DDE (UG/KG)	2.3	2.07	1.06	b
	Chromium (MG/KG)	16	52.3	0.11	a b
	Copper (MG/KG)	9.2	18.7	0.49	a b
	Endrin aldehyde (UG/KG)	4.2	3.3	1.27	a
	Lead (MG/KG)	52.3	30.2	1.73	a b
	Mercury (MG/KG)	0.51	0.14	3.92	a b
	Pyrene (UG/KG)	170	153	1.11	a
	Zinc (MG/KG)	9.8	124	0.08	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

Table 10-28-3  
 Phase IIA Detected Concentrations in Wetland 32 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Calcium (Ca)	2/2	1750 - 2260	2005.00
Iron (Fe)	2/2	182 - 191	186.50
Magnesium (Mg)	2/2	3050 - 4570	3810.00
Manganese (Mn)	2/2	9.3 - 10	9.65
Potassium (K)	2/2	1170 - 1780	1475.00
Sodium (Na)	2/2	30000 - 44400	37200.00
<b>Volatiles (<math>\mu\text{g/L}</math>)</b>			
Methylene chloride	1/2	14	14.00

**Note:**

All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### 10.28.3 Fate and Transport

No pathways were evaluated for the wetland specific fate and transport for reference Wetland 32.

### 10.28.4 Ecological Risk Assessment

HQs for Wetland 32 sediment samples are presented in Table 10-28-2. Phase IIA sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for lead in all three Wetland 32 sediment samples (3201, 1.37; 3202, 1.38; and 3203, 1.73), and also mercury (3.92) at sample location 3203. HQs were above 1 for 4,4'-DDD and 4,4'-DDE at sample locations 3201 (19.67 and 17.87), and 3203 (2.70 and 1.06), as well as for 4,4'-DDT (10.92) at sample location 3201. However, as noted in the nature and extent discussion, the concentrations of 4,4'-DDT and its metabolites were below basewide levels. HQs were also greater than 1 for the pesticides alpha-chlordane (7.06), gamma-chlordane (3.47), dieldrin (18.06), and endrin (4.55) at sample location 3201, as well as endrin aldehyde (1.27) at sample location 3202. HQs were also above 1 for the PCB Aroclor-1254 (9.72) at sample location 3201, and the SVOC pyrene (1.11) at sample location 3203. There were no surface water exceedances at Wetland 32.



Table 10-28-4 (1)

## Wetland 32

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W320301	Freshwater					
Iron		UG/L	191.0	1,000.0	0.191	a b
Methylene chloride		UG/L	14.0	1,500.0	0.00886	b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Wetland 32 is identified as a reference wetland (E/A&H, 1995a). Contaminants detected in reference wetlands were isolated and were generally below benchmark or reference values. In addition, contaminant exceedances did not appear to be related to IR sites. Therefore, except for Wetland 33 the reference wetlands were not studied further in Phase IIB/III.

### **10.28.5 Wetland 32 Human Health Risk Assessment**

#### **10.28.5.1 Samples Included**

##### **Sediment**

041M320101, 041M320201, 041M320301

##### **Surface Water**

041W320101, 041W320301

#### **10.28.5.2 Current and Future Land Use**

Wetland 32 is directly upstream of Wetland 33, and is in the undeveloped portion of NAS Pensacola. In 1995, a nature trail and boardwalk was built along the southern shore of Wetland 33, and the area was opened to the public. The land use is not anticipated to be changed, and fishing frequency is not known.

#### **10.28.5.3 Fish Tissue COPCs**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.28.5.4 Sediment COPCs**

As shown in Table 10-28-5, no sediment COPCs were identified.

#### **10.28.5.5 Surface Water COPCs**

As shown in Table 10-28-6, no surface water COPCs were identified.

TABLE 10-28-5  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 32 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Residential Soil RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	3.30		24.00		UG/KG		2 / 3	-	13.65	24.00	N/A	92000	2700	C	N/A	NO	BSL
72559	4,4'-DDE	2.2000		37.0000		UG/KG		2 / 3	-	19.60	37.00	N/A	65000	1500	C	N/A	NO	BSL
50293	4,4'-DDT	13.0000		13.0000		UG/KG		1 / 3	-	13.00	13.00	N/A	65000	1500	C	N/A	NO	BSL
11097691	Aroclor 1254	210.0000		210.0000		UG/KG		1 / 3	-	210.00	210.00	N/A	6300	160	N	N/A	NO	BSL
60571	Dieldrin	13.0000		13.0000		UG/KG		1 / 3	-	13.00	13.00	N/A	1400	40	C	N/A	NO	BSL
72208	Endrin	15.0000		15.0000		UG/KG		1 / 3	-	15.00	15.00	N/A	95000	2300	C	N/A	NO	BSL
7421934	Endrin aldehyde	4.2000		4.2000		UG/KG		1 / 3	-	4.20	4.20	N/A	95000	2300	N	N/A	NO	BSL
319846	alpha-BHC	1.4000		5.2000		UG/KG		2 / 3	-	3.30	5.20	N/A	3500	100	C	N/A	NO	BSL
5103719	alpha-Chlordane	12.0000		12.0000		UG/KG		1 / 3	-	12.00	12.00	N/A	63000	1800	C	N/A	NO	BSL
58899	gamma-BHC	1.4000		1.4000		UG/KG		1 / 3	-	1.40	1.40	N/A	17000	490	C	N/A	NO	BSL
5103742	gamma-Chlordane	5.9000		5.9000		UG/KG		1 / 3	-	5.90	5.90	N/A	63000	1800	C	N/A	NO	BSL
129000	Pyrene	170.0000		170.0000		UG/KG		1 / 3	-	170.00	170.00	N/A	9500000	230000	N	N/A	NO	BSL
78933	2-Butanone	70.0000		70.0000		UG/KG		1 / 3	-	70.00	70.00	N/A	190000000	4700000	N	N/A	NO	BSL
67641	Acetone	930.0000		1900.0000		UG/KG		2 / 3	-	1415.00	1900.00	N/A	32000000	780000	N	N/A	NO	BSL
108907	Chlorobenzene	14.0000		14.0000		UG/KG		1 / 3	-	14.00	14.00	N/A	6300000	160000	N	N/A	NO	BSL
7429905	Aluminum (Al)	3670.0000		7780.0000		MG/KG		3 / 3	NAV	5123.33	7780.00	N/A	320000	7800	N	N/A	NO	BSL
7440393	Barium (Ba)	6.7000		9.7000		MG/KG		3 / 3	NAV	8.50	9.70	N/A	22000	550	N	N/A	NO	BSL
7440417	Beryllium (Be)	0.5100		0.5100		MG/KG		1 / 3	-	0.51	0.51	N/A	630	16	N	N/A	NO	BSL
7440702	Calcium (Ca)	2150.0000		4320.0000		MG/KG		3 / 3	NAV	2966.67	4320.00	N/A	N/A	N/A	N/A	NO	NTX	
7440473	Chromium (Cr)	5.7000		7.2000		MG/KG		3 / 3	NAV	6.30	7.20	N/A	1600	23	N	N/A	NO	BSL
7440508	Copper (Cu)	5.7000		9.2000		MG/KG		3 / 3	NAV	6.80	9.20	N/A	13000	310	N	N/A	NO	BSL
7439896	Iron (Fe)	471.0000		832.0000		MG/KG		3 / 3	NAV	651.67	832.00	N/A	N/A	N/A	N/A	NO	NTX	
7439921	Lead (Pb)	41.3000		52.3000		MG/KG		3 / 3	NAV	45.07	52.30	N/A	400	400	OSWER	N/A	NO	BSL
7439954	Magnesium (Mg)	2230.0000		4280.0000		MG/KG		3 / 3	NAV	2990.00	4280.00	N/A	N/A	N/A	N/A	NO	NTX	
7439965	Manganese (Mn)	3.5000		5.6000		MG/KG		3 / 3	NAV	4.87	5.60	N/A	15000	1100	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.5100		0.5100		MG/KG		1 / 3	-	0.51	0.51	N/A	95	2.3	N	N/A	NO	BSL
7440097	Potassium (K)	306.0000		485.0000		MG/KG		3 / 3	NAV	408.00	485.00	N/A	N/A	N/A	N/A	NO	NTX	
7782492	Selenium (Se)	2.4000		3.6000		MG/KG		2 / 3	-	3.00	3.60	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	2580.0000		3680.0000		MG/KG		3 / 3	NAV	3080.00	3680.00	N/A	N/A	N/A	N/A	NO	NTX	
7440622	Vanadium (V)	5.2000		7.6000		MG/KG		3 / 3	NAV	6.47	7.60	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	6.8000		9.4000		MG/KG		3 / 3	NAV	8.03	9.40	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRG for trespasser scenario calculated using equations and parameters presented in Section 6 of this report.

(5) Residential soil RBC as presented in USEPA Region III RBC Tables, 1988.

(6) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Definitions:

NAV = Not Available

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable and Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

**TABLE 10-28-6**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 32 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Detection Frequency	Mean	(2) Concentration Used for Screening	(2) Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
7440702	Calcium (Ca)	1750		2260		UG/L	2 / 2	2005	2260	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	182		191		UG/L	2 / 2	186.5	191	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	3050		4570		UG/L	2 / 2	3810	4570	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	9.3		10		UG/L	2 / 2	9.65	10	N/A	2400	73	N	NO	BSL
7440097	Potassium (K)	1170		1780		UG/L	2 / 2	1475	1780	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium	30000		44400		UG/L	2 / 2	37200	44400	N/A	N/A	N/A	N/A	NO	EN
75092	Methylene chloride	14		14		UG/L	1 / 2	14	14	N/A	1000	4.1	C	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Tap water RBCs as presented in USEPA Region III RBC Tables (1998)

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.28.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 32.

#### **10.28.6 Conclusions and Recommendations**

Wetland 32 is identified as a reference wetland (E/A&H, 1995a), where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. Therefore, Wetland 32 was not studied further in Phase IIB/III. Since no COPCs were identified for Wetland 32, no formal HHRA was conducted. Because no ecological or human health risks are present at Wetland 32, this wetland is acceptable as a reference wetland.

## **10.29 WETLAND 33**

### **10.29.1 Site Description**

Wetland 33 is an estuarine lagoon on Navy property adjacent to NAS Pensacola to the southwest. The area is also known as Trout Point. Parsons and Pruitt (USEPA, 1991) described this system as an estuarine emergent wetland. Wetland 33 has an open water portion approximately 20 acres in size, with an outlet to Big Lagoon on its western end. Saw grass (*Cladium jamaicense*) and black needle rush (*Juncus roemerianus*) line the shoreline of this wetland.

In 1996, the Navy took steps to preserve the Trout Point area, which has been subject to minimal impact from surrounding development. The area around Wetland 33 was developed into a low impact recreational area, with a board walk and nature trail. The marsh within Wetland 33 was named Davis Marsh. No IR sites exist in the immediate vicinity of Wetland 33.

### **10.29.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-29-1 denotes the Phase IIA Wetland 33 sampling locations.

#### **Sediment**

Eighteen metals were detected in Wetland 33 sediment samples. No metals exceeded the appropriate sediment benchmark levels at Wetland 33. Five pesticides were detected in Wetland 33 sediment samples, to include 4,4'-DDE, aldrin, alpha-chlordane, and alpha/beta-BHC. 4,4'-DDE was detected below basewide levels at sample location 3301. All other pesticide detections were below screening criteria. The PCB Aroclor-1254 was detected in Wetland 58 sediment, at concentrations below the appropriate benchmark level. Sixteen SVOCs, mostly high and low molecular weight PAHs, were detected in Wetland 33 sediment samples. Ten SVOCs exceeded appropriate sediment criteria, including acenaphthene (180 ppb), anthracene (700 ppb), benzo(a)anthracene (1,800 ppb), benzo(a)pyrene (1,100 ppb), chrysene (1,500 ppb), fluoranthene

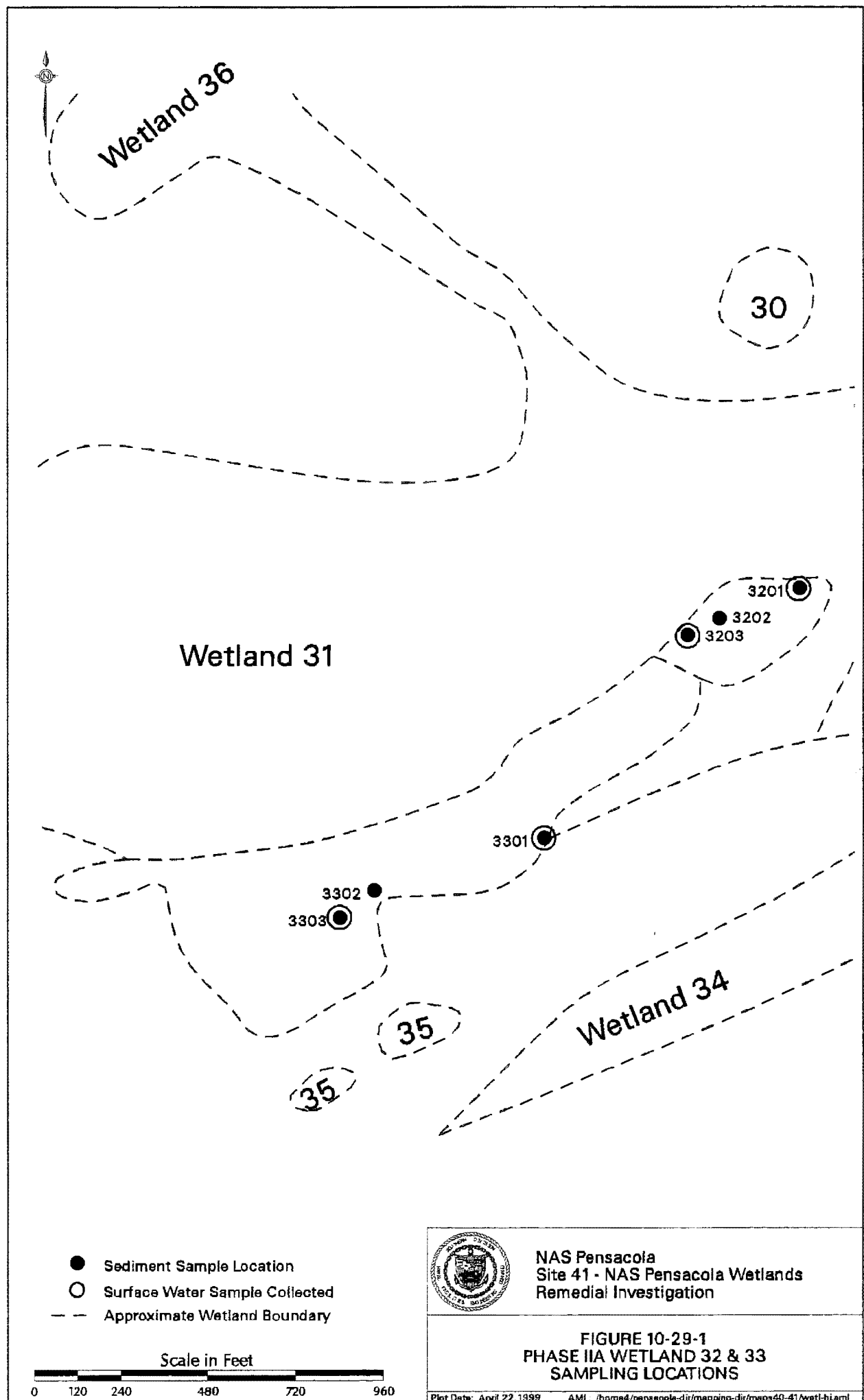
(2,700 ppb), fluorene (230 ppb), naphthalene (46 ppb), phenanthrene (1,900 ppb), and pyrene (2,900 ppb). All SVOC exceedances occurred at sample location 3303. The VOCs acetone and chlorobenzene were detected at Wetland 33. Acetone is a common laboratory contaminant.

Table 10-29-1 shows the Wetland 33 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-29-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.

#### **Surface Water**

Seven metals were detected in Wetland 33 surface water samples. Mercury (0.16 ppb) exceeded appropriate surface water quality criteria (0.025 ppb) at location 3303. No organics were detected in Wetland 33 surface water samples.

Table 10-29-3 shows the Wetland 33 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-29-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.





**Table 10-29-1**  
**Detected Concentrations in Wetland 33 Sediments**  
**NAS Pensacola Site 41, Phase II**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	3/3	135 - 2460	1371.67
Arsenic (As)	2/3	1.4 - 1.8	1.6
Barium (Ba)	3/3	0.3 - 2.6	1.4
Calcium (Ca)	3/3	116 - 1470	915.33
Chromium (Cr)	2/3	3.5 - 5.5	4.5
Chromium (Cr)	2/3	3.5	4.5
Cobalt (Co)	1/3	0.99	0.99
Copper (Cu)	3/3	0.49 - 8.1	4.49
Iron (Fe)	3/3	151 - 2120	1297
Lead (Pb)	3/3	0.69 - 13.3	8.63
Magnesium (Mg)	3/3	189 - 2420	1363
Manganese (Mn)	3/3	0.62 - 8.2	4.77
Nickel (Ni)	1/3	3	3
Potassium (K)	3/3	70.3 - 698	384.77
Selenium (Se)	1/3	0.66	0.66
Sodium (Na)	3/3	979 - 10100	5606.33
Vanadium (V)	3/3	0.38 - 4.7	3.13
Zinc (Zn)	2/3	8.3 - 14	11.15
<b>Pesticides and PCBs (µg/kg)</b>			
4,4'-DDE	1/3	3.1	3.1
Aldrin	2/3	0.18 - 0.44	0.31
Aroclor-1254	2/3	2.4 - 12	7.2
alpha-BHC	2/3	0.3 - 0.39	0.345
alpha-Chlordane	2/3	0.35 - 0.7	0.525
delta-BHC	2/3	0.13 - 0.57	0.35
<b>Semivolatiles (µg/kg)</b>			
Anthracene	1/3	700	700
Benzo(a)anthracene	1/3	1800	1800
Benzo(a)pyrene	1/3	1100	1100
Benzo(b)fluoranthene	1/3	1100	1100
Benzo(g,h,i)perylene	1/3	740	740
Benzo(k)fluoranthene	1/3	710	710
Carbazole	1/3	220	220
Chrysene	1/3	1500	1500
Di-n-butylphthalate	1/3	32	32

Remedial Investigation  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-29-1  
 Detected Concentrations in Wetland 33 Sediments  
 NAS Pensacola Site 41, Phase II

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Semivolatiles (<math>\mu\text{g/kg}</math>)</b>			
Dibenzofuran	1/3	70	70
Fluoranthene	1/3	2700	2700
Fluorene	1/3	230	230
Indeno(1,2,3-cd)pyrene	1/3	740	740
Naphthalene	1/3	46	46
Phenanthrene	1/3	1900	1900
Pyrene	1/3	2900	2900
<b>Volatiles (<math>\mu\text{g/kg}</math>)</b>			
Acetone	1/3	270	270
Chlorobenzene	1/3	6	6

**Table 10-29-2 (1)**  
**Wetland 33**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M330101</b>					
	4,4'-DDE (UG/KG)	3.1	2.07	1.50	b
	Arsenic (MG/KG)	1.8	7.24	0.25	a b
	Chromium (MG/KG)	5.5	52.3	0.11	a b
	Copper (MG/KG)	8.1	19.7	0.43	a b
	Lead (MG/KG)	13.3	33.2	0.44	a b
	Nickel (MG/KG)	3	15.9	0.19	a b
	Zinc (MG/KG)	14	124	0.11	a b
<b>041M330102</b>					
	4,4'-DDE (UG/KG)	3.1	2.07	1.50	b
	Arsenic (MG/KG)	1.8	7.24	0.25	a b
	Chromium (MG/KG)	5.5	52.3	0.11	a b
	Copper (MG/KG)	8.1	19.7	0.43	a b
	Lead (MG/KG)	13.3	33.2	0.44	a b
	Nickel (MG/KG)	3	15.9	0.19	a b
	Zinc (MG/KG)	14	124	0.11	a b
<b>041M330301</b>					
	Arenaphthene (UG/KG)	180	5.71	26.83	b
	alpha-Chlordane (UG/KG)	0.35	1.7	0.21	a
	Anthracene (UG/KG)	700	45.9	14.93	b
	Aroclor-1254 (UG/KG)	2.4	21.6	0.11	b
	Benzo(a)anthracene (UG/KG)	1800	74.8	24.06	b
	Benzo(a)pyrene (UG/KG)	1100	88.8	12.39	b
	Chrysene (UG/KG)	1500	108	13.89	b
	Copper (MG/KG)	0.49	19.7	0.03	a b
	Fluoranthene (UG/KG)	2700	113	23.89	b
	Fluorene (UG/KG)	230	21.2	10.86	b
	Lead (MG/KG)	0.69	33.2	0.02	a b
	Naphthalene (UG/KG)	45	34.6	1.33	b
	Phenanthrene (UG/KG)	1800	86.7	21.91	b
	Pyrene (UG/KG)	2900	153	18.95	b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

**Table 10-29-3**  
**Detected Concentrations in Wetland 33 Surface Water**  
**NAS Pensacola Site 4I, Phase II**

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Calcium (Ca)	2/2	14100 - 21700	17900
Iron (Fe)	2/2	183 - 189	186
Magnesium (Mg)	2/2	40100 - 64600	52350
Manganese (Mn)	2/2	6.3 - 8.2	7.25
Mercury (Hg)	1/2	0.16	0.16
Potassium (K)	2/2	12300 - 20900	16600
Sodium (Na)	2/2	315000 - 547000	431000

Table 10-29-4 (1)

## Wetland 33

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W330301	Saltwater	UG/L	183.0	300.0	61	(a)
		UG/L	0.16	0.025	64	(b)

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1990)

Some of the numbers in the table may vary because of rounding.

### **10.29.3 Fate and Transport**

No pathways were evaluated for the wetland specific fate and transport for reference Wetland 33.

### **10.29.4 Ecological Risk Assessment**

HQs for Wetland 33 sediment samples are presented in Table 10-29-2. Phase IIA sediment results revealed an HQ above 1 for 4,4'-DDE (1.50) at sample location 3301. However, as noted in the Nature and Extent discussion, this 4,4'-DDE concentration was below basewide levels. Ten SVOCs had HQs greater than 1, all at sample location 3303. These included acenaphthene (26.83), anthracene (14.93), benzo(a)anthracene (24.06), benzo(a)pyrene (12.39), chrysene (13.89), fluoranthene (23.89), fluorene (10.85), naphthalene (1.33), phenanthrene (21.91), and pyrene (18.95). Phase IIA results of the single Wetland 33 surface water sample revealed a HQ above 1 for mercury (6.40). HQs greater than one indicate the potential for excess risk.

Wetland 33 is identified as a reference wetland (E/A&H, 1995a). Contaminants detected in reference wetlands were isolated and were generally below screening values. In addition, contaminant exceedances did not appear to be related to IR sites. Wetland 33 was the only reference wetland included in the Phase IIB/III studies, as further discussed in this section.

### **Phase IIB/III**

Reference Wetland 33 was sampled for chemical, toxicity, diversity, and bioaccumulation (fish tissue) analysis, with results compared to other wetlands where appropriate. Two sediment samples and two surface water samples were collected from Wetland 33 for chemical analysis.

### **Sampling Location Rationale**

In August of 1997, two Phase IIB/III sediment samples were collected locations 33-01 and 33-02 for toxicity analysis, sediment chemistry, TOC, grain size, and benthic diversity. Three composite grab samples for benthic diversity were collected within 10 feet of each sample location to account for spatial variability. Sample locations were at the same locations as Phase IIA shown on

Figure 10-29-1. The number and lengths of the fish collected at reference Wetland 33 are presented in Table 10-29-5.

**Table 10-29-5**  
**Fish Species Collected from Wetland 33**

Sample Location	Species	Number Collected	Length Range (millimeters)
33-01	Pinfish ( <i>Lagodon rhomboides</i> )	7	55-71
33-02	Pinfish ( <i>Lagodon rhomboides</i> )	25	54-85

### Ecological Risk Evaluation

Risk in Wetland 18 was evaluated with respect to three assessment endpoints: 1) piscivorous bird health and reproduction, 2) survival, growth, and reproduction of macroinvertebrates associated with the benthic environment, and 3) protection of fish viability.

### Piscivorous Bird Health and Reproduction:

The results of this model, as shown in Table 10-29-6, estimate no excess risk posed by total DDT and PCBs in fish tissue collected at 33-01 and 33-02. HQs estimated for heron exposure to total DDT in fish tissues from both sampling locations are below 1 using an SFF of 1. PCBs were not detected in the fish tissue. Therefore, the condition of Wetland 33 is acceptable for this assessment endpoint.

**Table 10-29-6**  
**Great Blue Heron HQ Calculations**  
**Wetland 33**

SFF Value	Location	Parameter	Tissue Concentration <sup>1</sup> (mg/kg)	Sediment Concentration <sup>2</sup> (mg/kg)	PDE <sup>3</sup> (mg/kg-day)	NOAEL <sup>4</sup> (mg/kg-day)	LOAEL (mg/kg-day)	HQ <sup>5</sup>
1	33-01	total DDT	7.0	0.06	0.001	0.003	0.028	0.33
1	33-02	total DDT	2.9	ND	0	0.003	0.028	0

**Notes:**

- 1 = Whole body killifish or pinfish (wet weight).
- 2 = Samples from top 5 cm of sediment (wet weight).
- 3 = Potential Dietary Exposure: revised from model in SAP (E/A&H, 1997).
- 4 = Effects Levels in Sample *et al.*, 1996.
- 5 = Hazard Quotient = (PDE) ÷ (NOAEL).
- ND = Not detected
- NOAEL = No-observed-adverse-effects-level.
- LOAEL = Lowest-observed-adverse-effects-level.

### **Survival and Growth of Macroinvertebrates Associated with the Benthic Environment:**

As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach. Based on the ecological risk evaluation performed at Wetland 33, sediment results can be scored via the decision making triad, and the overall condition of the wetland for sediment can be determined.

### **Sediment Chemistry**

Table 10-29-7 compares detected Phase IIB/III sediment concentrations to benchmark levels, and lists calculated HQs for each parameter. DDT and its metabolites are also compared to basewide levels (see Section 6). Only the detected parameters with benchmark levels are presented in Table 10-29-7. As shown, sediment HQ values are greater than one for 4,4'-DDD and gamma-BHC. However, the DDD concentration is below the basewide level (see Section 6). Cadmium is the only other detected parameter with an HQ above 1. Since gamma-BHC is the only exceedance, a matrix score of “—” for sediment chemistry is applied.

### **Sediment Toxicity**

Survival results for Wetland 33 sediments for the *Leptocheirus* test were 92 % for location 33-01, and 96 % for location 33-02, as presented in Table 10-29-8. Survival results for the *Neanthes* test were 92 % for location 33-01, and 100 % for location 33-02, as presented in the table. Application of these results to the decision making triad discussed in Section 7.14 revealed a triad matrix score of “—” for the amphipod and polychaete tests.



Table 10-29-7 (1)

## Wetland 33

## Phase IIB/III Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M33019</b>					
	Chromium (MG/KG)	1.6	52.3	0.03	a b
	Copper (MG/KG)	2.8	18.7	0.14	a b
	Lead (MG/KG)	5.6	30.2	0.22	a b
	Nickel (MG/KG)	0.91	15.9	0.06	a b
	Pyrene (UG/KG)	18	153	0.12	b
	Zinc (MG/KG)	3.7	124	0.03	a b
<b>041M33020</b>					
	4,4'-DDD (UG/KG)	2	1.22	1.64	b
	Chromium (MG/KG)	1.7	52.3	0.03	a b
	Copper (MG/KG)	2.8	18.7	0.14	a b
	gamma-BHC (Lindane) (UG/KG)	1.1	0.37	3.44	b
	Lead (MG/KG)	5.6	30.2	0.22	a b
	Nickel (MG/KG)	0.91	15.9	0.06	a b
	Pyrene (UG/KG)	18	153	0.12	b
	Zinc (MG/KG)	3.7	124	0.03	a b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

Table 10-29-8  
 Toxicity Test Results  
 Wetland 33 Sediment

Site	<i>Leptocheirus</i>	<i>Neanthes</i>	Weight (mg)	Triad Matrix Scoring
	% Survival	% Survival		
Control (negative)	99	100	8.5	
Wetland 33 (33-01)	92	92	10.7	—
Wetland 33 (33-02)	96	100	10.1	—

### Benthic Diversity

Wetland 33 sediments were sampled, for species diversity classification in Phase IIB/III of this study. A total of 44 organisms were collected and sorted into four dominant species. Location 33-01 contained a large diversity of gastropods. *Littorina irrorata*, the marsh periwinkle, *Detracia floridana*, and *Melampus* species were well represented within this area. *Streblospio benedicti*, a polychaete commonly found in brackish water marshes was abundant at this site also. *Almyracuma* species, a type of cumacean was collected here and is viewed as an indicator of a healthy environment. Benthic diversity results and application to the triad matrix are presented in Table 10-29-9. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-29-9  
 Benthic Diversity Results and Application to the Triad Matrix  
 Wetland 33 Sediment

Site	Shannon-Weiner Diversity	Pielou's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 33 (33-01)	5.46	2.63	7.74	—

Table 10-29-10 presents the interpretation of the triad analysis for the Wetland 33 Phase IIB/III sediment samples. Based on the results of the chemistry and toxicity data, condition number 2 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

Table 10-29-10  
 Triad Analysis Interpretation  
 Wetland 33 Sediment

Location	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 33	—	—	—	Strong evidence for the absence of pollution induced degradation.

Condition number 2 denotes that Wetland 33 sediments are acceptable, and that the wetland is acceptable as a reference wetland.

#### Protection of Fish Viability:

Protection of fish viability was evaluated using three lines of evidence for Wetland 33. The first line of evidence, a direct comparison of tissue residue concentrations to toxic effects thresholds in Level 3 fish, shows that no one contaminant had an HQ above 1. The comparison is provided in Table 10-29-11.

For the second line of evidence, risk to Level 4 fish were also evaluated as presented in Table 10-29-12. An HQ greater than 1 was calculated for heptachlor, endrin ketone, and mercury using an SFF of 1. The calculated mercury concentration based on the mean detected concentration is used to more closely approximate the detected mercury concentrations in Wetland 33 sediment. It is important to note that the mean concentration (0.14 mg/kg) used in the calculation (Appendix G) is approximately twice the Wetland 33 sediment detected concentration (0.06 mg/kg), therefore, the risk estimate is approximately doubled. Wetland 33, approximately 20 acres in size, is open to Pensacola Bay, an approximately 97,280 acre water body. Assuming the Level 4 fish finds all of Pensacola Bay to be attractive, an SFF of 0.00021 is calculated. No one HQ is greater than 1.

For the third line of evidence, water quality parameters were compared to water quality criteria. Dieldrin (0.004 ppb) was the only parameter to exceed its water quality criteria (0.0019 ppb). This comparison is provided in Table 10-29-13.

## Conclusion

With only one surface water quality criteria exceedance, no exceedances of screening values for maximum concentrations in Level 3 fish, and no exceedances of screening values for Level 4 fish using an SFF of 0.00002, the condition of this wetland appears to be acceptable for this assessment endpoint.

Table 10-29-11  
 Contaminant HQ Calculations from Fish Tissue Samples  
 Wetland 33

Constituent	Maximum Level 3 Fish Tissue Conc (mg/kg)	Level 3 Fish Tissue Conc. (mg/kg)	Screening Ecotoxicity Values (mg/kg)	HQ
4,4-DDT	5.2	0.0052	0.10 <sup>1</sup>	0.052
4,4-DDE	1.8	0.0018	0.10 <sup>1</sup>	0.018
Heptachlor	0.72	0.00072	0.01 <sup>2</sup>	0.072
Endrin Ketone	1.4	0.0014	0.019 <sup>3</sup>	0.07
gamma Chlordane	1.1	0.0011	0.01 <sup>4</sup>	0.11

**Notes:**

Available: <http://www.wes.army.mil/el/t2dbase.html>

- 1 0.10 mg/kg NOED for mortality in the spiny dogfish, from Guarino, A.M. and S.T. Arnold (1979).
- 2 0.01 mg/kg NOED for mortality in the spot, from Schimmel, S.C., Patrick, J.M., Forester, J. (1976).
- 3 0.019 mg/kg NOED for physiological effects in the rainbow trout, from Grant, B.F. and P.M. Mehrle (1973).
- 4 0.01 mg/kg NOED for mortality in the sheepshead minnow, from Schimmel, S.C., Patrick, J.M., Forester, J. (1976).

Table 10-29-12  
 Contaminant HQ Calculations from Fish Tissue Samples  
 Wetland 33

Constituent	Level 3 Fish Tissue Conc (mg/kg)	TTC	Level 4 Tissue Conc (SFF = 1) (mg/kg)	Level 4 Tissue Conc (SFF = 0.00021) (mg/kg)	Screening Ecotoxicity Value (mg/kg)	HQ (Based on SFF = 1)	HQ (Based on (SFF = 0.00021)
4,4'-DDT	0.0052	3.254	0.017	0.000004	3.0 <sup>1</sup>	0.006	0
4,4'-DDE	0.0018	3.602	0.0065	0.000002	3.0 <sup>1</sup>	0.003	0
Heptaclor	0.0072	1.342	0.22	0.000047	0.01 <sup>2</sup>	22	0.0047
Gamma-Chlordane	0.0011	1.999	0.0022	0.000001	0.01 <sup>3</sup>	0.22	0.0001
Endrin Ketone	0.0014	3.733	0.325	0.000069	0.019 <sup>4</sup>	17.1	0
Mercury			0.36 <sup>5</sup>	0.008	0.14 <sup>6</sup>	2.6	0.06

Notes:

- 1 3 mg/kg NOED for morphological effects in the Atlantic Salmon, from Addison, R.F., M.E. Einck and J.R. Leahy (1976).
- 2 0.01 mg/kg NOED for mortality in the spot, from Schimmel, S.C., Patrick, J.M., Forester, J. (1976).
- 3 0.019 mg/kg NOED for physiological effects in the rainbow trout, from Grant, B.F. and P.M. Mehrle (1973).
- 4 0.01 mg/kg NOED for mortality in the sheepshead minnow, from Schimmel, S.C., Patrick, J.M., Forester, J. (1976).
- 5 The mercury concentration was calculated using the model presented in Appendix G.
- 6 0.14 mg/kg NOED for mortality in the rainbow trout, Boudou, A. and F. Ribeyre (1985).

Table 10-29-13 (1)

## Wetland 33

## Phase IIB/III Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
041W330201	Saltwater	US/L	162.00	1500.00	0.11	n
	Aluminum	US/L	102.00	300.00	0.34	b

## Notes

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

## **10.29.5 Human Health Risk Assessment**

### **10.29.5.1 Site Description**

Section 10.29.1 provides a detailed description of Wetland 33 and the area surrounding this wetland.

### **10.29.5.2 Samples Included**

#### **Wetland 33 Sediment Samples**

041M3301, 041M3302

#### **Wetland 33 Surface Water Samples**

041W3301, 041W3302

#### **Wetland 33 Fish Tissue Samples**

041J3301, 041J3302

### **10.29.5.3 Current and Future Land Use**

Wetland 33 is in the undeveloped portion of NAS Pensacola. In 1995, a nature trail and boardwalk was built along the southern shore of Wetland 33, and the area was opened to the public. The land use is not anticipated to change, and fishing frequency is not known.

### **10.29.5.4 Sediment COPCs**

As shown in Table 10-29-14, no sediment COPCs were identified.

### **10.29.5.5 Fish Tissue COPCs**

As shown in Table 10-29-15, the following tissue COPCs were identified.

- 4,4'-DDE
- 4,4'-DDT
- Heptachlor
- gamma-Chlordane

TABLE 10-29-14  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 33 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	Concentration Used for Screening	(2) Background Value	(3) Adolescent Site Trespasser PRG	(4) Residential Soil RBC	(5) Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection	
72548	4,4'-DDD	2.00	J	2.00		UG/KG	041M330201	1 / 1	NAV	2.00	2	N/A	92000	2700	C	N/A	NO	BSL
7429905	Aluminum (Al)	705.00		748.00		MG/KG	041M330201	2 / 2	NAV	726.50	748	N/A	320000	7800	N	N/A	NO	BSL
7440393	Barium (Ba)	0.69	J	0.89	J	MG/KG	041M330201	2 / 2	NAV	0.79	0.89	N/A	22000	550	N	N/A	NO	BSL
7440417	Beryllium (Be)	0.08	J	0.08		UG/KG	041M330201	1 / 2	0.05 - 0.05	0.0800	0.08	N/A	630	16	N	N/A	NO	BSL
7440702	Calcium (Ca)	236.00		853.00		MG/KG	041M330101	2 / 2	NAV	544.50	853	N/A	N/A	N/A	N	N/A	NO	EN
7440473	Chromium (Cr)	1.60		1.70		MG/KG	041M330101	2 / 2	NAV	1.65	1.7	N/A	1600	23	N	N/A	NO	BSL
7440508	Copper (Cu)	2.40		2.60		MG/KG	041M330101	2 / 2	NAV	2.50	2.6	N/A	13000	310	N	N/A	NO	BSL
7439896	Iron (Fe)	517.00		852.00		MG/KG	041M330101	2 / 2	NAV	689.50	862	N/A	N/A	N/A	N	N/A	NO	EN
7439921	Lead (Pb)	4.40		6.60		MG/KG	041M330101	2 / 2	NAV	5.50	6.6	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	328.00		943.00		MG/KG	041M330101	2 / 2	NAV	635.50	943	N/A	N/A	N/A	N	N/A	NO	EN
7439965	Manganese (Mn)	2.00		2.50		MG/KG	041M330101	2 / 2	NAV	2.25	2.5	N/A	15000	1100	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.05		0.06		UG/KG	041M330101	1 / 2	0.02 - 0.02	0.0600	0.06	N/A	95	2.3	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.91	J	0.93		MG/KG	041M330201	2 / 2	NAV	0.92	0.93	N/A	6300	160	N	N/A	NO	BSL
7440097	Potassium (K)	102.00		194.00		MG/KG	041M330201	2 / 2	NAV	148.00	194	N/A	N/A	N/A	N	N/A	NO	EN
129000	Pyrene	18.00	J	18.00		UG/KG	041M330201	1 / 2	570.00 - 570.00	18.0000	18	N/A	9500000	230000	N	N/A	NO	BSL
7782492	Selenium (Se)	0.38	J	0.39	J	MG/KG	041M330201	2 / 2	NAV	0.39	0.39	N/A	1600	39	N	N/A	NO	BSL
7440235	Sodium (Na)	1060.00		2920.00		MG/KG	041M330201	2 / 2	NAV	1990.00	2920	N/A	N/A	N/A	N	N/A	NO	EN
7440622	Vanadium (V)	1.50	J	2.20		MG/KG	041M330201	2 / 2	NAV	1.85	2.2	N/A	2200	55	N	N/A	NO	BSL
7440666	Zinc (Zn)	3.70	J	6.50		MG/KG	041M330101	2 / 2	NAV	5.10	6.5	N/A	95000	2300	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Maximum concentration used as screening value.

(3) Background values not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in USEPA Region III Risk-Based Concentration Tables, 1998.

(5) RBCs for residential scenario as presented in USEPA Region III Risk-Based Concentration Tables, 1998.

(6) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Essential Nutrient (EN)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic



TABLE J-29-15  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Future  
Medium: Fish  
Exposure Medium: Fish  
Exposure Point: Wetland 33 Fish

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Fish Ingestion RBC	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
72559	4,4'-DDE	1.5	J	1.8	J	UG/KG	041J330101	2 / 2	NAV	1.65	18	N/A	9.3 C	N/A	YES	ASL
50293	4,4'-DDT	1.4	J	5.2	J	UG/KG	041J330101	2 / 2	NAV	3.3	52	N/A	9.3 C	N/A	YES	ASL
7421934	Endrin aldehyde	1.4	J	1.4	J	UG/KG	041J330201	1 / 2	1.4 - 1.4	1.4	14	N/A	406 N	N/A	NO	BSL
53494705	Endrin ketone	0.75	J	0.75	J	UG/KG	041J330101	1 / 2	3.3 - 3.3	0.75	7.5	N/A	406 N	N/A	NO	BSL
76448	Heptachlor	0.72	J	0.72	J	UG/KG	041J330101	1 / 2	1.7 - 1.7	0.72	7.2	N/A	0.7 C	N/A	YES	ASL
7435921	Lead (Pb)	0.43	J	0.47	J	MG/KG	041J330201	2 / 2	NAV	0.45	4.70	N/A	N/A	N/A	NO	NTX
5103742	gamma-Chlordane	1.1	J	1.1	J	UG/KG	041J330101	1 / 2	0.29 - 0.29	1.1	11	N/A	9 C	N/A	YES	ASL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value

(3) No background values were developed for this media.

(4) RBCs for fish tissue ingestion presented in USEPA Region III Risk-Based Concentration Tables, 1998.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Detection Reason: Below Screening Levels (BSL)

Background Levels (BKG)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.29.5.6 Surface Water COPCs**

As shown in Table 10-29-16, no surface water COPCs were identified.

#### **10.29.5.7 Risk Characterization**

##### ***Fish Tissue***

##### **Recreational Fishermen**

For carcinogenic risks (Table 10-29-17), cumulative risk using the modified 95<sup>th</sup> percentile fish ingestion rates (4.3 g/day) is below the 1E-06 threshold level. As presented in Table 10-29-18, the calculated hazard index for noncarcinogenic effects for recreational fishermen is well below 1 (1 is the regulatory threshold level for noncarcinogens).

##### **Hypothetical Subsistence Fishermen**

For carcinogenic risks (Table 10.29.19), the cumulative risk for hypothetical subsistence fishermen based on the modified 95% percentile fish ingestion rate (19.5 g/day) is well below the 1E-06 threshold level. As presented in Table 10.29.20, the hazard index for non-carcinogenic effects for hypothetical subsistence fishermen is below 1.

A summary of the risk estimates for both of the receptor populations evaluated is presented in Table 10.29.21.

#### **10.29.6 Conclusions and Recommendations**

Wetland 33 is identified as a reference wetland (E/A&H, 1995a), where contaminants were mostly isolated, generally below benchmark or reference values, and did not appear to be related to IR sites. Wetland 33 was the only reference wetland included in the Phase IIB/III studies.

The ecological risk assessment for Wetland 33 measured the assessment endpoint for benthic macroinvertebrate community diversity and toxicity, and for sediment chemistry, toxicity, and

TABLE 10-29-16  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 33 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Tap Water RBC	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Detection or Selection	
67641	Acetone	13.00	J	13.00		UG/L	041W330101	1 / 2	NAV	13.00	13	N/A	21000	370	N	N/A	NO	BSL
7429905	Aluminum (Al)	162.00		169.00		UG/L	041W330101	2 / 2	NAV	165.50	169	N/A	120000	3700	N	N/A	NO	BSL
7440360	Antimony (Sb)	3.10	J	3.10	J	UG/L	041W330101	1 / 2	NAV	3.10	3.1	N/A	48	1.5	N	N/A	NO	BSL
7440393	Barium (Ba)	7.20	J	10.70		UG/L	041W330101	2 / 2	NAV	8.95	10.7	N/A	8300	260	N	N/A	NO	BSL
7440702	Calcium (Ca)	18800.00		100000.00		UG/L	041W330101	2 / 2	NAV	59400.00	100000	N/A	N/A	N/A	N/A	NO	EN	
7440508	Copper (Cu)	2.40	J	2.40	J	UG/L	041W330101	1 / 2	NAV	2.40	2.4	N/A	4800	150	N	N/A	NO	BSL
60571	Dieldrin	0.0040	J	0.0040	J	UG/L	041W330101	1 / 2	NAV	0.00	0.004	N/A	0.14	0.0042	C	N/A	NO	BSL
7439896	Iron (Fe)	89.70	J	102.00	J	UG/L	041W330201	2 / 2	NAV	95.85	102	N/A	N/A	N/A	N/A	NO	EN	
7439954	Magnesium (Mg)	55600.00		322000.00		UG/L	041W330101	2 / 2	NAV	188800.00	322000	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	9.30	J	9.30	J	UG/L	041W330201	1 / 2	NAV	9.30	9.3	N/A	2400	73	N	N/A	NO	BSL
7440097	Potassium (K)	23300.00		155000.00		UG/L	041W330101	2 / 2	NAV	89150.00	155000	N/A	N/A	N/A	N/A	NO	EN	
7440235	Sodium (Na)	462000.00		2780000.00		UG/L	041W330101	2 / 2	NAV	1611000.00	2780000	N/A	N/A	N/A	N/A	NO	EN	
7440622	Vanadium (V)	0.83	J	0.83		UG/L	041W330101	1 / 2	NAV	0.83	0.83	N/A	830	26	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) PRGs for adolescent site trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(4) Tap water RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1998).

(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
Essential Nutrient (EN)  
No Toxicity Information (NTX)

Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

TABLE 10-29-17  
CALCULATION OF CANCER RISKS  
RECREATIONAL FISH INGESTION  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route: Ingestion  
Exposure Point: Wetland 33  
Receptor Population: Recreational Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake (Cancer)	Intake (Cancer) Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDE	1.8E-03	mg/kg	2.6E-09	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	9E-10
4,4'-DDT	5.2E-03	mg/kg	9.6E-09	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	3E-09
Heptachlor	7.2E-04	mg/kg	1.2E-09	mg/kg-day	4.5E+00	(mg/kg-day) <sup>-1</sup>	5E-09
Chlordane	1.10E-03	mg/kg	1.1E-09	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	5E-09
Total Pathway Risk							1E-08

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

TABLE 10-29-18  
CALCULATION OF HAZARD QUOTIENTS  
RECREATIONAL FISH INGESTION  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route: Ingestion  
Exposure Point: Wetland 33  
Receptor Population: Recreational Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake (Noncarcinogenic)	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDE <sup>2</sup>	1.8E-03	mg/kg	6.0E-09	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDT	5.2E-03	mg/kg	2.2E-08	mg/kg-day	5.0E-04	mg/kg-day	4E-05
Heptachlor	7.2E-04	mg/kg	2.7E-09	mg/kg-day	5.0E-04	mg/kg-day	5E-06
Chlordane	1.10E-03	mg/kg	2.5E-09	mg/kg-day	5.0E-04	mg/kg-day	5E-06
Total Pathway HI							6E-05

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.

TABLE 10-29-19  
CALCULATION OF CANCER RISKS  
SUBSISTENCE FISH INGESTION  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route: Ingestion  
Exposure Point: Wetland 33  
Receptor Population: Hypothetical Subsistence Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral Slope Factor	Slope Factor Units	Cancer Risk
4,4'-DDE	1.8E-03	mg/kg	1.2E-08	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	4E-09
4,4'-DDT	5.2E-03	mg/kg	4.4E-08	mg/kg-day	3.4E-01	(mg/kg-day) <sup>-1</sup>	2E-08
Heptachlor	7.2E-04	mg/kg	5.4E-09	mg/kg-day	4.5E+00	(mg/kg-day) <sup>-1</sup>	2E-08
Chlordane	1.10E-03	mg/kg	5.0E-09	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	2E-09
Total Pathway Risk							5E-08

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

TABLE 10-29-20  
OCCURRENCE, CALCULATION OF HAZARD QUOTIENTS  
SUBSISTENCE FISH INGESTION  
NAS PENSACOLA SITE 41

Scenario: Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route: Ingestion  
Exposure Point: Wetland 33  
Receptor Population: Hypothetical Subsistence Fishermen

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Intake	Intake Units	Oral RfD	RfD Units	Hazard Quotient
4,4'-DDE <sup>2</sup>	1.8E-03	mg/kg	2.8E-08	mg/kg-day	NA	mg/kg-day	NA
4,4'-DDT	5.2E-03	mg/kg	1.0E-07	mg/kg-day	5.0E-04	mg/kg-day	2E-04
Heptachlor	7.2E-04	mg/kg	1.3E-08	mg/kg-day	5.0E-04	mg/kg-day	3E-05
Chlordane	1.10E-03	mg/kg	1.2E-08	mg/kg-day	5.0E-04	mg/kg-day	2E-05
Total Pathway HI							3E-04

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.

<sup>2</sup> Noncarcinogenic effects can not be determined due to the lack of an oral RfD.

TABLE 10-29-21  
RISK SUMMARY  
FISH TISSUE INGESTION  
NAS PENSACOLA SITE 41

Timeframe: Current and Future  
Medium: Fish tissue  
Exposure Route : Ingestion  
Exposure Point: Wetland 33

Chemical of Potential Concern	Medium EPC Value <sup>1</sup>	Medium EPC Units	Recreational Fishermen		Subsistence Fishermen	
			Hazard Quotient	Cancer Risk	Hazard Quotient	Cancer Risk
4,4'-DDE	1.8E-03	mg/kg	NA	9E-10	NA	4E-09
4,4'-DDT	5.2E-03	mg/kg	4E-05	3E-09	2E-04	2E-08
Heptachlor	7.2E-04	mg/kg	5E-06	5E-09	3E-05	2E-08
Chlordane	1.10E-03	mg/kg	5E-06	5E-09	2E-05	2E-09
<b>Cumulative HI / Cancer Risk</b>			6E-05	1E-08	3E-04	5E-08

N/A - Not applicable (value cannot be determined due to lack of toxicological reference information)

<sup>1</sup> For fish tissue calculations, the maximum detected concentration was used as the EPC.



biodiversity. Assessment for benthic toxicity showed no acute or chronic effects. A large diversity of gastropods and other organisms were found in this wetland, including species indicative of a healthy environment. Decision making triad results for Phase IIB/III sediment analytical results revealed an overall condition number 2 for sediment at Wetland 33, denoting that sediments are acceptable at this wetland.

The HHRA identified no sediment or surface water COPCs. Fish tissue COPCs included 4,4'-DDE, 4,4'-DDT, heptachlor, and gamma-chlordane. However, the calculated risk for both the recreational and trespasser scenarios were within the acceptable risk levels.

Wetland 33 is in the undeveloped portion of NAS Pensacola, contains a nature trail and boardwalk, and is open to the public. The land use is not anticipated to change, and fishing frequency is not known. Though open to base personnel and the public, the Trout Point area is not easily accessible. Foot traffic must traverse the boardwalk for approximately 0.25 miles to get to Wetland 33, and the shallow estuary is not readily accessible by boat.

Because of the limited overall ecological risk at Wetland 33 and the acceptable risk levels for human health, this wetland is considered acceptable as a reference wetland.

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### 10.30 WETLAND W1

#### 10.30.1 Site Description

Wetland W1 is on the southwest side of Forrest Sherman Field, paralleling the north/south runway of the airfield. It is a cleared, maintained area which functions as a buffer zone along the southwest side of Runway 19/01 at NAS Pensacola's Forrest Sherman Field. This site was not classified or described by Parsons and Pruitt (USEPA, 1991), but was later added to the list by E&E, Inc. It is maintained as a clear area (devoid of tall shrubs and trees) for flight safety reasons. The site functions as a drainage pathway for surface runoff which collects on the southwest portion of Sherman Field. Wetland W1 is contoured, which results in a low swale running length-wise, north-to-south, along the site's center. Surface water collects in this swale and flows offsite through a series of storm drains. Surface water from the southern end of Wetland W1 drains into Wetland 52 and surface water from the northern side of Wetland W1 drains to the north into Wetland 72 via a storm sewer. The water table along the swale is only a few inches below land surface, resulting in boggy, saturated areas containing wetland herbs and shrubs. Because the area is frequently mowed and purposely maintained clear of tall vegetation, the site has not developed into the palustrine scrub-shrub wetland that would likely exist there if left unaltered.

Vegetation on the site consists primarily of wild flowers, herbs, and grasses typical to meadows and pastures. Pockets of shrubs have developed along the centerline of the swale near drainage structures, and near obstacles avoided by mowing equipment. A number of plant species with facultative or obligate wetland status are found along the wet swale. Examples of herbs include umbrella grass (*Fuirena scirpoidea*), yellow eyed grass (*Xyris fimbriata*), common pipewort (*Eriocaulon decangulare*), meadow beauty (*Rhexia mariana*), blazing star (*Liatris spicata*), white bracted sedge (*Dichromena latifolia*), marsh fleabane (*Pluchea rosea*), redroot, (*Lachnanthes caroliniana*), yellow top, (*Flaveria linearis*), swamp pennywort (*Hydrocotyle verticillata*), sedge (*Cyperus polystachyos*) and rushes (*Juncus, sp.*) Shrubs include

wax myrtle (*Myrica cerifera*), ink berry (*Ilex glabra*), sea myrtle (*Baccharis halimifolia*), highbush blackberry (*Rubus argutus*), spoon-leaf sundew (*Drosera intermedia*), and St. John's wort (two species) (*Hypericum brachyphyllum*, and *H. cistifolium*).

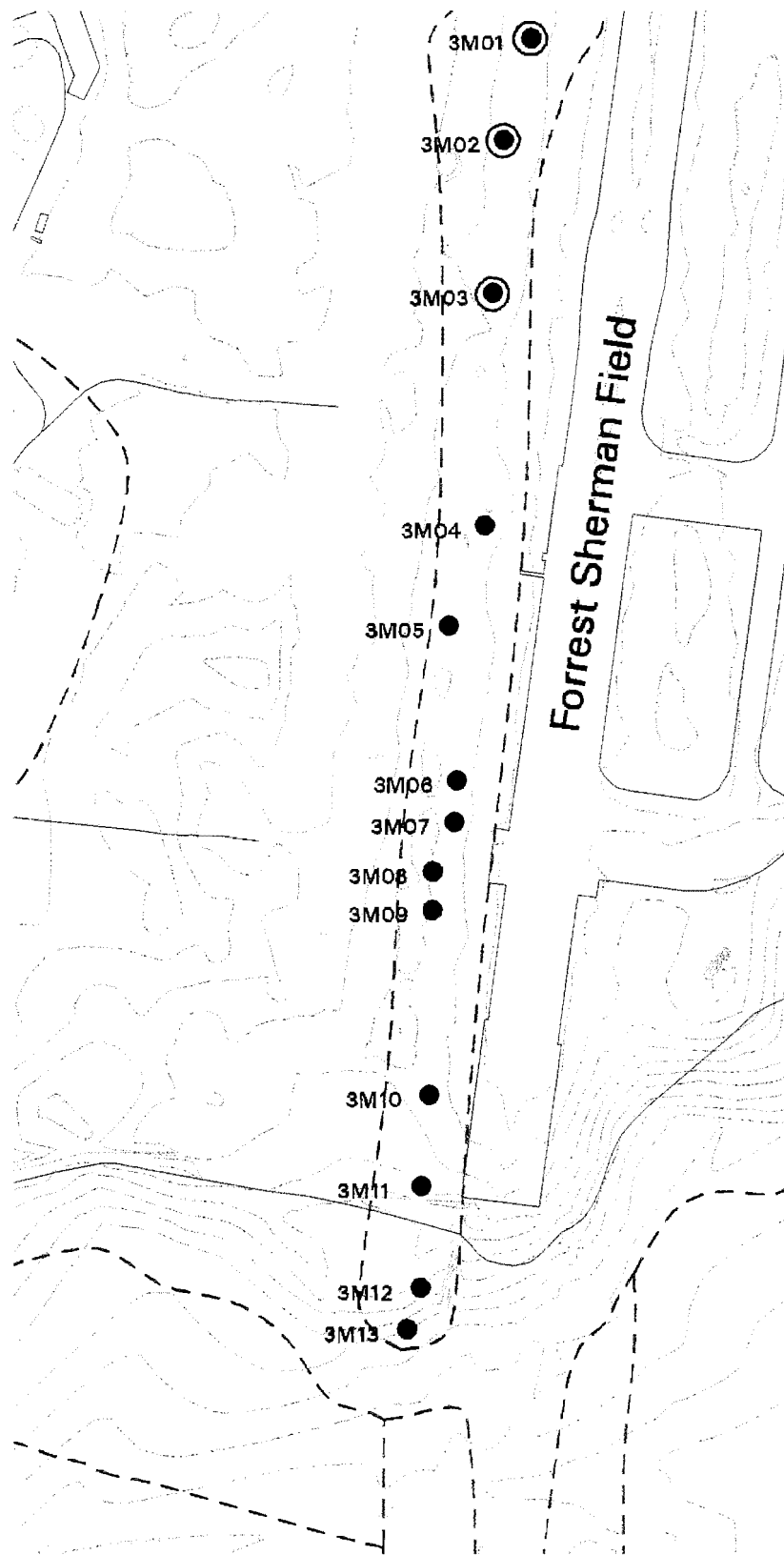
Wetland W1 has been classified as nonjurisdictional by FDEP and the Corps of Engineers. However, the data collected are included in this RI report. IR site potentially affecting Wetland W1 includes UST 18 (Crash Crew Training Area), which is adjacent to Wetland W1 to the west.

#### **10.30.2 Nature and Extent**

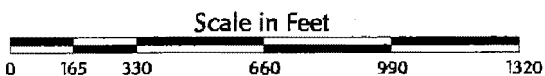
The methods for evaluating nature and extent are presented in Section 6. Figure 10-30-1 denotes Phase IIA Wetland W1 sampling locations.

#### **Sediment**

Twenty metals were detected in Wetland W1 sediment samples. Eleven metals, including aluminum, cadmium, chromium, cobalt, copper, iron, lead, mercury, selenium, vanadium, and zinc exceeded terrestrial ecological screening values. Metals exceedances primarily occurred at sample locations 3M03, 3M04, and 3M05. Aluminum, chromium and iron exceeded the terrestrial screening values in all 13 samples. Three pesticides were detected in Wetland W1 sediment samples, including DDT and its metabolites. Sample location 3M08 contained DDD (170 ppb) and DDE (66 ppb) above basewide levels. Nine SVOCs were detected in Wetland W1 sediment samples, with all concentrations appearing above terrestrial ecological screening values. Benzo(a)anthracene (98 ppb), benzo(k)fluoranthene (93 ppb), chrysene (110 ppb), fluoranthene (210 ppb), phenanthrene (160 ppb), and pyrene (180 ppb) exceeded terrestrial screening values at sample location 3M01. Hexachlorobenzene (120 ppb) exceeded terrestrial screening values at sample location 3M04. 2-methylnaphthalene (240 ppb), and naphthalene (300ppb) exceeded terrestrial screening values at sample location 3M07.



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

FIGURE 10-30-1  
PHASE IIA WETLAND W1  
SAMPLING LOCATIONS

One VOC, xylene, was detected above the terrestrial screening value (50 ppb) at sample location 3M07 (680 ppb).

Table 10-30-1 shows the Wetland W1 Phase IIA sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-30-2 compares detected concentrations at each sample location to terrestrial screening levels, and lists calculated HQs for each parameter which will be further discussed in the ecological risk section.

### **Surface Water**

Ten metals were detected in Wetland W1 surface water samples. Copper, iron and lead exceeded surface water quality criteria at Wetland W1 (iron and lead exceeded criteria in all three samples). Three SVOCs were detected in Wetland W1 surface water samples, including 2-methylnaphthalene, bis(2-ethylhexyl)phthalate (the only exceedance, 5 ppb at location 01), and naphthalene. Six VOCs, distributed between samples 01 and 02, were detected in Wetland W1 surface water samples, including acetone (a common laboratory contaminant), benzene, cis 1,2-dichloroethene, ethylbenzene, toluene, and xylene. No VOC concentration exceeded any surface water quality criteria.

Table 10-30-3 shows the Wetland W1 Phase IIA surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-30-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. The HQs will be further discussed in the ecological risk section.

Final Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 10: Site-Specific Evaluations  
 August 31, 2000

Table 10-30-1  
 Phase IIA Detected Concentrations in Wetland W1 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	13/13	1450 - 9540	2930.77
Arsenic (As)	1/13	0.84	0.84
Barium (Ba)	13/13	2 - 30.9	9.91
Beryllium (Be)	4/13	0.06 - 0.26	0.17
Cadmium (Cd)	9/13	0.86 - 6	2.52
Calcium (Ca)	13/13	78 - 9130	1672.46
Chromium (Cr)	13/13	2 - 68.7	9.1
Cobalt (Co)	11/13	0.46 - 28.7	15.18
Copper (Cu)	12/13	0.57 - 86.3	16.85
Iron (Fe)	13/13	215 - 5230	1274.08
Lead (Pb)	13/13	5.7 - 950	167.09
Magnesium (Mg)	13/13	31.2 - 231	89.32
Manganese (Mn)	13/13	0.52 - 42	11.43
Mercury (Hg)	1/13	0.11	0.11
Nickel (Ni)	9/13	2.3 - 10.2	4.99
Potassium (K)	1/13	117	117
Selenium (Se)	7/13	0.27 - 3.7	1.13
Sodium (Na)	13/13	6.6 - 57.5	16.96
Vanadium (V)	13/13	1.9 - 10.1	4.15
Zinc (Zn)	13/13	0.83 - 126	25.53
<b>Pesticides and PCBs (μg/kg)</b>			
4,4'-DDD	3/13	9.1-170	65.37
4,4'-DDE	1/13	66	66
4,4'-DDT	1/13	17	17
<b>Semivolatiles (μg/kg)</b>			
2-Methylnaphthalene	1/13	240	240
Benzo(a)anthracene	1/13	98	98
Benzo(k)fluoranthene	1/13	93	93
Chrysene	1/13	110	110
Fluoranthene	1/13	210	210
Hexachlorobenzene	1/13	120	120
Naphthalene	1/13	300	300
Phenanthrene	1/13	160	160
Pyrene	1/13	180	180
<b>Volatiles (μg/kg)</b>			
Xylene (Total)	1/13	680	680

**Note:**

All results are in micrograms per kilogram (μg/kg) or parts per billion (ppb), except for metals which are in milligrams per kilogram (mg/kg) or parts per million (ppm).

**Table 10-30-2 (1)**  
**Welland W1**  
**Phase IIA Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>003M000101</b>					
	Benzo(a)anthracene (UG/KG)	98	74.8	1.31	b
	Chromium (MG/KG)	2.5	52.3	0.05	a b
	Chrysene (UG/KG)	110	108	1.02	b
	Copper (MG/KG)	4.5	18.7	0.24	a b
	Fluoranthene (UG/KG)	210	113	1.86	b
	Lead (MG/KG)	14.2	30.2	0.47	a b
	Nickel (MG/KG)	3.7	15.9	0.23	a b
	Phenanthrene (UG/KG)	160	86.7	1.85	b
	Pyrene (UG/KG)	180	153	1.18	b
	Zinc (MG/KG)	11	124	0.09	a b
<b>003M000301</b>					
	Arsenic (MG/KG)	0.84	7.24	0.12	a b
	Cadmium (MG/KG)	1.9	0.68	2.79	b
	Chromium (MG/KG)	68.7	52.3	1.31	a b
	Copper (MG/KG)	40.2	18.7	2.15	a b
	Lead (MG/KG)	950	30.2	31.46	a b
	Nickel (MG/KG)	4.7	15.9	0.30	a b
	Zinc (MG/KG)	126	124	1.02	a b
<b>003M000501</b>					
	Cadmium (MG/KG)	8	0.68	8.82	b
	Chromium (MG/KG)	11.6	52.3	0.22	a b
	Copper (MG/KG)	86.3	18.7	4.61	a b
	Lead (MG/KG)	833	30.2	27.58	a b

**Notes:**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP-SQAGs  
 Some of the numbers in this table may vary because of rounding.



Table 10-30-2 (2)  
Wetland W1  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Mercury (MG/KG)	0.11	0.13	0.85	a b
	Zinc (MG/KG)	97.7	124	0.79	a b
<b>003M000701</b>					
	2-Methylnaphthalene (UG/KG)	240	20.2	11.88	b
	4,4'-DDD (UG/KG)	17	1.22	13.93	b
	Cadmium (MG/KG)	0.85	0.88	1.28	b
	Chromium (MG/KG)	6.3	52.3	0.12	a b
	Copper (MG/KG)	6.6	18.7	0.35	a b
	Lead (MG/KG)	42.3	30.2	1.40	a b
	Naphthalene (UG/KG)	300	34.6	8.67	b
	Zinc (MG/KG)	15.2	124	0.12	a b
<b>003M000901</b>					
	4,4'-DDD (UG/KG)	9.1	1.22	7.46	b
	Chromium (MG/KG)	4	52.3	0.08	a b
	Copper (MG/KG)	6.3	18.7	0.34	a b
	Lead (MG/KG)	9.7	30.2	0.32	a b
	Nickel (MG/KG)	3.8	15.9	0.24	a b
	Zinc (MG/KG)	7.6	124	0.06	a b

Notes:

- (a) USEPA Screening Concentration for Sediment - EPA SSVs  
 (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs  
 Some of the numbers in the table may vary because of rounding.

Table 10-30-2 (3)  
Wetland W1  
Phase IIA Sediment Concentrations Compared to Benchmark Levels

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
	Nickel (MG/KG)	23	15.9	0.14	a b
	Zinc (MG/KG)	1.1	124	0.01	a b
<b>003M001101</b>					
	Chromium (MG/KG)	2.5	52.3	0.05	a b
	Lead (MG/KG)	5.7	30.2	0.19	a b
	Zinc (MG/KG)	1.6	124	0.01	a b
<b>003M001301</b>					
	Chromium (MG/KG)	2.1	52.3	0.04	a b
	Copper (MG/KG)	3.6	18.7	0.19	a b
	Lead (MG/KG)	10.5	30.2	0.34	a b
	Nickel (MG/KG)	4.1	15.9	0.26	a b
	Zinc (MG/KG)	4.6	124	0.04	a b

**Notes**

- (a) USEPA Screening Concentration for Sediment - EPA SSVs
  - (b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs
- Some of the numbers in the table may vary because of rounding.

Table 10-30-3  
 Phase IIA Detected Concentrations in Wetland W1 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (<math>\mu\text{g/L}</math>)</b>			
Aluminum (Al)	2/3	1840 - 2270	2055
Barium (Ba)	1/3	57.8	57.8
Copper (Cu)	2/3	6.6 - 7.8	7.2
Calcium (Ca)	3/3	3620 - 6790	4926.67
Iron (Fe)	3/3	610 - 2790	1993.33
Lead (Pb)	3/3	4.7 - 56.4	23.53
Magnesium (Mg)	3/3	736 - 1020	863.33
Manganese (Mn)	3/3	5.7 - 27.4	13.5
Potassium (K)	3/3	361 - 1410	837.33
Vanadium (V)	3/3	2.9 - 10.8	5.67
<b>Pesticides and PCBs (<math>\mu\text{g/L}</math>)</b>			
alpha-Chlordane	1/3	0.25	0.25
<b>SVOCs (<math>\mu\text{g/L}</math>)</b>			
2-Methylnaphthalene	1/3	3	3
bis(2-Ethylhexyl)phthalate (BEHP)	1/3	5	5
Naphthalene	1/3	6	6
<b>VOCs (<math>\mu\text{g/L}</math>)</b>			
Acetone	1/1	13	13
Benzene	2/3	16 - 24	20
cis-1,2-Dichloroethene	1/3	3	3
Ethylbenzene	2/3	7 - 11	9
Toluene	2/3	3	3
Xylene (Total)	2/3	46 - 150	98

**Note:**

The total number of samples has been reduced by the number of rejected samples. However, note that no positive results were rejected. All results are in micrograms per liter ( $\mu\text{g/L}$ ) or parts per billion (ppb).

### 10.30.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Sediment transport and storm water runoff data are lacking; thus many evaluations are qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-30-5 presents those contaminants present in sediment above benchmark levels and their calculated SSLs.

Table 10-30-4 (1)

## Wetland W1

## Phase IIA Surface Water Concentrations Compared to Water Quality Criteria

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041WW10101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	1,840.0	87.0	21.14943	a
	Benzene	UG/L	18.0	53.0	0.30189	a
	Copper	UG/L	7.8	7.8	1.0	a b
	Ethylbenzene	UG/L	7.0	153.0	0.01545	a
	Iron	UG/L	2,580.0	1,000.0	2.58	a b
	Lead	UG/L	56.4	1.71	32.98246	a b
	Naphthalene	UG/L	6.0	62.0	0.09677	a
	Toluene	UG/L	3.0	175.0	0.01714	a

041WW10301	Freshwater					
	Aluminum	UG/L	1,110	87.0	12.6437	a
	Benzene	UG/L	17.0	53.0	0.32075	a
	Copper	UG/L	7.2	7.8	0.92308	a b
	Ethylbenzene	UG/L	7.0	153.0	0.01545	a
	Iron	UG/L	8.6	1,000.0	0.0086	a b
	Lead	UG/L	7.4	1.71	4.32749	a b
	Naphthalene	UG/L	1,080.4	62.0	17.4258	a
	Toluene	UG/L	1.8	175.0	0.01029	a
		UG/L	1.8	1,000.0	0.0018	a b

## 041WW10301 Freshwater

Iron	UG/L	810.0	1,000.0	0.81	a b
Lead	UG/L	4.7	1.71	2.74854	a b

## Notes:

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

Table 10-30-5  
 Calculated Sediment Screening Values for Wetland W1

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
<b>Inorganics</b>	<b>(ppm)</b>		<b>(ppm)</b>	<b>(ppm)</b>	
Chromium	11 <sup>a,b</sup>	1.9E+01	21.04	68.7	YES
Copper	6.54 <sup>a</sup>	4.3E+02	335.5	86.3	NO
Lead	1.32 <sup>a</sup>	9E+02	153.92	950	YES
Zinc	70.2 <sup>a,b</sup>	6.2E+01	435.24	126	NO
<b>Organics</b>	<b>(ppb)</b>		<b>(ppb)</b>	<b>(ppb)</b>	
4,4 DDD	0.0064 <sup>a</sup>	1.99E+04	1.27E+04	170	NO
Benzo(a)anthracene	0.031 <sup>b</sup>	6.2E+04	1.92E+05	98	NO
Chrysene	0.031 <sup>b</sup>	6.2E+04	1.92E+05	110	NO
Fluoranthene	39.8 <sup>a</sup>	2.13E+03	8.48E+06	210	NO
Naphthalene	62 <sup>a</sup>	39.98	2.47E+05	300	NO
Phenanthrene	0.031 <sup>b</sup>	599.76	1.86E+03	160	NO
Pyrene	11,000 <sup>b</sup>	2099	2.31E+10	180	NO

**Notes:**

Kd for organics calculated using foc of 0.02 (conservative literature value).

Kds are from: USEPA, 1996b (first preference); Superfund Chemical Data Matrix (USEPA, 1996c) (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference — primary reference for inorganics).

Kd = normalized partitioning coefficient.

SSL = sediment screening level.

DF = dilution factor.

a = USEPA Freshwater Surface Water Chronic Screening Value (1995a).

b = FDEP Class III Water Quality Criteria (1996).

Contaminants present in surface water above water quality criteria were presented on Table 10-30-4.

## **Transport into the Wetland**

### *Surface Water/Sediment Pathway*

Based on landlord and watershed analysis, the following sources can contribute contamination to Wetland W1 through this pathway:

- Potential storm water runoff and sediment entrainment from UST 18 and the southern end of the north-south runway at the Forrest Sherman airfield complex.

The presence of sediment contaminant above benchmark level (see Table 10-23-5) validates the sediment transport pathway and by inference the surface water pathway. Additionally, two organics were present in surface water above standards, further validating the pathway.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis, the following sources can contribute contamination to Wetland W1 through this pathway:

- Discharge from UST 18.

## **Transport within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of the wetland, along with landlord analysis, indicates that surface water and sediment migrates to the north and into Bayou Grande, and to the south into Wetland 52 and Pensacola Bay. Transport occurs within a buried storm water culvert system that sources the wetland in the vicinity of UST 18. Therefore, both sediment and surface water contamination can be expected to remain mobile.

#### *Sediment Leaching to Surface Water Pathway*

Seven organics and four inorganics exceeded their respective SSVs, but only chromium and lead exceeded their SSLs. The presence of lead above the SSL and the associated presence of fuel-related organics in the corresponding surface water sample indicate the source for contamination to be UST 18. The fuel-related organics are likely to be associated with the groundwater or surface water pathways, while the lead in surface water is at least partly attributable to sediment leaching. This pathway is considered valid, with a high potential for lead to partition to surface water.

#### **Transport from the Wetland**

Surface water and sediment can be expected to enter the storm water culvert system and exit the immediate vicinity. Therefore contamination can be expected to be mobile and the pathway is considered valid.

#### **10.30.4 Ecological Risk Assessment**

HQs for Wetland W1 sediment samples are presented in Table 10-20-2. Phase IIA sediment sample results compared to the appropriate terrestrial soil benchmark levels revealed a HQ above 1 for aluminum (ranging from 29.0 to 190.8), chromium (ranging from 5.0 to 171.75), and iron (ranging from 1.08 to 26.15) at all thirteen locations sampled. Cadmium exceeded an HQ of 1 (3.75) at location 3M05. Cobalt exceeded an HQ of 1 at four locations, with values ranging from 1.02 to 1.44. Copper had HQs above 1 at locations 3M03 and 3M05, with values of 1.01 and 2.16, respectively. Lead and zinc had HQs above 1 at locations 3M03 (19.0/2.52), 3M04 (4.90/1.11), and 3M05 (16.66/1.95). Mercury at location 3M05 had an HQ of 1.10. Selenium had HQs of 1.09, 4.57, and 1.6, respectively, at locations 3M03, 3M05, and 3M06. 4, 4'DDD at locations 3M07 and 3M09 had HQs of 6,800 and 3,640, respectively. The SVOCs fluoranthene, phenanthrene, and pyrene had HQs of 2,100, 1,600, and 1,800, respectively, at location 3M01. HQs above 1 for 2-Methylnaphthalene (2,400) and naphthalene (3,000) were

found at location 3M 07. Hexachlorobenzene had a HQ above 1 (48,000) at location 3M04. Xylene at location 3M07 had a HQ of 13,600.

Phase IIA surface water results revealed HQs greater than 1 for four metals, one pesticide, and one SVOC. Locations 01 and 02 had HQs above 1 for aluminum (21.15/26.09), iron (2.58/2.79), and lead (32.98/5.56). Lead also had an HQ above 1 at location 03 (2.75). The pesticide, alpha-chlordane, and the SVOC bis(2-Ethylhexyl)phthalate had HQs above 1 at location 02 (58.14 and 16.67 respectively). HQs greater than 1 indicate a potential for excess risk.

Wetland W1 was classified in Group D and was not studied further in Phase IIB/III.

#### **10.30.5 Human Health Risk Assessment**

##### **10.30.5.1 Samples Included**

###### **Sediment**

003M000101, 003M000201, 003M000301, 003M000401, 003M000501, 003M000601,  
003M000701, 003M000801, 003M000901, 003M001001, 003M001101, 003M001201,  
003M001301

###### **Surface Water**

041WW10101, 041WW10201, 041WW10301

##### **10.30.5.2 Current and Future Land Use**

Wetland W1 is a part of a 0.25 mile wide cleared buffer on the west side of Runway 13/31 at Forrest Sherman Field. The buffer is present for use in aircraft emergencies. It is unlikely this use will change in the future. Public access is restricted, and the area is patrolled by airfield security personnel.



#### **10.30.5.3 Fish COPCs Identified**

No fish tissue data were available for this wetland, and this exposure pathway would likely be incomplete; therefore, no COPCs were identified.

#### **10.30.5.4 Sediment COPCs Identified**

As shown in Table 10-30-6, the following sediment COPC was identified.

- Lead

#### **10.30.5.5 Surface Water COPCs Identified**

As shown in Table 10-30-7, the following chemical was identified as a COPC:

- Lead

#### **10.30.5.6 Risk Characterization**

##### ***Lead Risk Characterization***

A conservative exposure scenario was developed to assess the significance of surface water concentrations of lead at Wetland W1. This scenario involves a child (age 6 to 7) who accompanies an older sibling to the wetland one day a week for the year. Exposure to Wetland W1 surface water was addressed as an additional exposure relative to typical exposures encountered at the child's place of residence. This additional exposure was presented as an "alternate" source within the constructs of the Lead Model. The standard default assumptions in the lead model were kept to simulate background lead exposures. This was done to provide a conservative estimate of daily intake from sources unrelated to Wetland W1.

TABLE 10-30-6  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland W1 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	MEAN	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser prg	(5) Commercial Maintenance Worker Screening Toxicity Value	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Detection or Selection
91576	2-Methylnaphthalene	240.0000	J	240.0000	J	UG/KG	003M000701	1 / 13	380.00 - 56000.00	240.00	240.00	N/A	13000000	20000000	N	N/A	NO BSL
72548	4,4'-DDD	9.1000	J	170.0000	J	UG/KG	003M000701	3 / 13	3.80 - 9.10	65.37	170.00	N/A	92000	57000	C	N/A	NO BSL
72559	4,4'-DDE	66.0000	J	66.0000	J	UG/KG	003M000801	1 / 13	3.80 - 9.10	66.00	66.00	N/A	65000	41000	C	N/A	NO BSL
50293	4,4'-DDT	17.0000	J	17.0000	J	UG/KG	003M000801	1 / 13	3.80 - 9.10	17.00	17.00	N/A	65000	41000	C	N/A	NO BSL
7440382	Arsenic (As)	0.8400	J	0.8400	J	MG/KG	003M000301	1 / 13	0.42 - 1.40	0.84	0.84	N/A	15	9	C	N/A	NO BSL
56563	Benzo(a)anthracene	98.0000	J	98.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	98.00	98.00	N/A	30000	19000	C	N/A	NO BSL
207089	Benzo(k)fluoranthene	93.0000	J	93.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	93.00	93.00	N/A	300000	190000	C	N/A	NO BSL
7440417	Beryllium (Be)	0.0600	J	0.2600	J	MG/KG	003M000501	4 / 13	0.06 - 0.11	0.17	0.26	N/A	630	980	N	N/A	NO BSL
7440439	Cadmium (Cd)	0.8600	J	6.0000	J	MG/KG	003M000501	4 / 13	0.30 - 0.60	2.52	6.00	N/A	320	490	N	N/A	NO BSL
218019	Chrysene	110.0000	J	110.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	110.00	110.00	N/A	3000000	1900000	C	N/A	NO BSL
7440484	Cobalt (Co)	0.4600	J	28.7000	J	MG/KG	003M001001	11 / 13	0.48 - 1.50	15.18	28.70	N/A	19000	29000	N	N/A	NO BSL
7440508	Copper (Cu)	0.5700	J	86.3000	J	MG/KG	003M000601	12 / 13	0.39 - 0.39	16.85	86.30	N/A	13000	20000	N	N/A	NO BSL
206440	Fluoranthene	210.0000	J	210.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	210.00	210.00	N/A	N/A	N/A	N	N/A	NO BSL
118741	Hexachlorobenzene	120.0000	J	120.0000	J	UG/KG	003M000401	1 / 13	380.00 - 56000.00	120.00	120.00	N/A	14000	8600	C	N/A	NO BSL
7439976	Mercury (Hg)	0.1100	J	0.1100	J	MG/KG	003M000501	1 / 13	0.02 - 0.09	0.11	0.11	N/A	95	150	N	N/A	NO BSL
91203	Naphthalene	300.0000	J	300.0000	J	UG/KG	003M000701	1 / 13	380.00 - 56000.00	300.00	300.00	N/A	13000000	20000000	N	N/A	NO BSL
7440020	Nickel (Ni)	2.3000	J	10.2000	J	MG/KG	003M000201	9 / 13	1.50 - 4.90	4.99	10.20	N/A	6300	9800	N	N/A	NO BSL
85018	Phenanthrene	160.0000	J	160.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	160.00	160.00	N/A	9500000	15000000	N	N/A	NO BSL
7440097	Potassium (K)	117.0000	J	117.0000	J	MG/KG	003M001201	1 / 13	94.20 - 307.00	117.00	117.00	N/A	N/A	N/A	N	N/A	NO NTX
129000	Pyrene	180.0000	J	180.0000	J	UG/KG	003M000101	1 / 13	380.00 - 56000.00	180.00	180.00	N/A	9500000	15000000	N	N/A	NO BSL
7782492	Selenium (Se)	0.2700	J	3.7000	J	MG/KG	003M000701	7 / 13	0.25 - 0.42	1.13	3.70	N/A	1600	2500	N	N/A	NO BSL
91576	2-Methylnaphthalene	240.0000	J	240.0000	J	UG/KG	003M000701	1 / 13	11.00 - 140.00	680.00	240.00	N/A	13000000	9800000	N	N/A	NO BSL
7429905	Aluminum (Al)	1450.0000	J	9540.0000	J	MG/KG	003M001201	13 / 13	NAV	2930.77	9540.00	N/A	320000	490000	N	N/A	NO BSL
7440393	Barium (Ba)	2.0000	J	30.9000	J	MG/KG	003M000101	13 / 13	NAV	10.18	30.90	N/A	22000	34000	N	N/A	NO BSL
7440702	Calcium (Ca)	78.0000	J	9130.0000	J	MG/KG	003M000401	13 / 13	NAV	1672.46	9130.00	N/A	N/A	N/A	N	N/A	NO NTX
7440473	Chromium (Cr)	2.0000	J	68.7000	J	MG/KG	003M001201	13 / 13	NAV	9.05	68.70	N/A	1600	2500	N	N/A	NO BSL
7439896	Iron (Fe)	215.0000	J	5230.0000	J	MG/KG	003M000201	13 / 13	NAV	1274.08	5230.00	N/A	N/A	N/A	N	N/A	NO NTX
7439921	Lead (Pb)	5.7000	J	950.0000	J	MG/KG	003M000301	13 / 13	NAV	167.09	950.00	N/A	400	400	OSWER	YES	ASL
7439954	Magnesium (Mg)	31.2000	J	231.0000	J	MG/KG	003M001101	13 / 13	NAV	89.32	231.00	N/A	N/A	N/A	N	N/A	NO NTX
7439965	Manganese (Mn)	0.5200	J	42.0000	J	MG/KG	003M000801	13 / 13	NAV	11.43	42.00	N/A	15000	23000	N	N/A	NO BSL
7440235	Sodium (Na)	6.6000	J	57.5000	J	MG/KG	003M000401	13 / 13	NAV	16.96	57.50	N/A	N/A	N/A	N	N/A	NO NTX
7440622	Vanadium (V)	1.9000	J	10.1000	J	MG/KG	003M001101	13 / 13	NAV	4.15	10.10	N/A	2200	3400	N	N/A	NO BSL
7440666	Zinc (Zn)	0.8300	J	126.0000	J	MG/KG	003M000301	13 / 13	NAV	25.53	126.00	N/A	95000	150000	N	N/A	NO BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) No background values were developed for this media.

(4) PRGs for trespasser scenario calculated using equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial site worker calculated using equations and parameters presented in Section 8 of this report.

(6) Rationale Codes  
Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)

Definitions: NAV = Not Available

N/A = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic

**TABLE 10-30-7**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland W1 Surface Water

		(1)		(1)							(2)		(3)	(4)			(5)	
CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	Concentration Used for Screening	Background Value	Adolescent Site Trespasser PRG	Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection	
91576	2-Methylnaphthalene	3		3		UG/L	041WW10101	1 / 3	NAV	3	3	N/A	330	1000	N	N/A	NO	BSL
67641	Acetone	13	J	13	J	UG/L	041WW10101	1 / 3	NAV	13	13	N/A	21000	35000	N	N/A	NO	BSL
7429905	Aluminum (Al)	1840	J	2270	J	UG/L	041WW10201	2 / 3	NAV	2055	2270	N/A	120000	250000	N	N/A	NO	BSL
7440393	Barium (Ba)	57.8	J	57.8	J	UG/L	041WW10201	1 / 3	NAV	57.8	57.8	N/A	6300	18000	N	N/A	NO	BSL
71432	Benzene	16		24		UG/L	041WW10201	2 / 3	NAV	20	24	N/A	91	100	C	N/A	NO	BSL
7440702	Calcium (Ca)	3280	J	6790	J	UG/L	041WW10101	3 / 3	NAV	4927	6790	N/A	N/A	N/A	N/A	NO	EN	
7440506	Copper (Cu)	6.6	J	7.8	J	UG/L	041WW10101	2 / 3	NAV	7.2	7.8	N/A	4800	10000	N	N/A	NO	BSL
100414	Ethylbenzene	7		11		UG/L	041WW10201	2 / 3	NAV	9	11	N/A	1200	3700	N	N/A	NO	BSL
7439896	Iron (Fe)	610		2790		UG/L	041WW10201	3 / 3	NAV	1993	2790	N/A	N/A	N/A	N/A	NO	EN	
7439921	Lead (Pb)	4.7		56.4		UG/L	041WW10101	3 / 3	NAV	23.5	56.4	N/A	15	15	TTAL	YES	ASL	
7439954	Magnesium (Mg)	736	J	1020	J	UG/L	041WW10101	3 / 3	NAV	863	1020	N/A	N/A	N/A	N/A	NO	EN	
7439965	Manganese (Mn)	5.7	J	27.4		UG/L	041WW10101	3 / 3	NAV	13.5	27.4	N/A	2400	5000	N	N/A	NO	BSL
81203	Naphthalene	6		6		UG/L	041WW10101	1 / 3	NAV	6	6	N/A	330	1000	N	N/A	NO	BSL
7440097	Potassium (K)	361	J	1410	J	UG/L	041WW10201	3 / 3	NAV	837	1410	N/A	N/A	N/A	N/A	NO	EN	
108883	Toluene	3		3		UG/L	041WW10201	2 / 3	NAV	3	3	N/A	3800	11000	N	N/A	NO	BSL
7440622	Vanadium (V)	2.9	J	10.8	J	UG/L	041WW10201	3 / 3	NAV	5.7	10.8	N/A	830	1800	N	N/A	NO	BSL
1330207	Xylene (Total)	46		150	D	UG/L	041WW10201	2 / 3	NAV	98	150	N/A	19000	59000	N	N/A	NO	BSL
5103719	alpha-Chlordane	0.25	J	0.25		UG/L	041WW10201	1 / 3	NAV	0.25	0.25	N/A	2.1	2.7	C	N/A	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (	5		5		UG/L	041WW10201	1 / 3	NAV	5	5	N/A	110	130	C	N/A	NO	BSL
156592	cis-1,2-Dichloroethene	3		3		UG/L	041WW10101	1 / 3	NAV	3	3	N/A	670	1700	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Levels (BSL)

Background Levels (BKG)

Essential Nutrient (EN)

No Toxicity Information (NTX)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

TTAL = Treatment Technique Action Level

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

The assumption was made that this child would incidentally ingest 100 mg of sediment and 0.05 liters of surface water during each visit. Within the Lead Model, an alternate source was entered to account for this exposure as previously discussed. The bioavailability of lead ingested from the alternate source (Wetland W1 surface water) was equal to that of drinking water lead ingested from the standard residential default source. Assuming incidental ingestion of 100 mg of sediment and 0.05 liters of surface water once per week with lead concentrations of 950 mg/kg and 56.4  $\mu\text{g/L}$ , the annual alternate source exposure was estimated to be 13.9  $\mu\text{g}$  lead/day. Table 10-30-8 presents the lead model output for a child 6 to 7 years old under these exposure conditions.

Figure 10-30-2 shows the probability percentage of blood lead levels for the hypothetical child receptor. Based on this model output, the geometric mean blood level is estimated to be 3.8  $\mu\text{g/dL}$ , and the probability of blood lead levels in excess of 10  $\mu\text{g/dL}$  is 1.76%. USEPA generally considers media concentrations that result in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. As a result, sediment and surface water lead concentrations at Wetland W1 would not require specific action under the hypothetical exposure scenario.

#### **10.30.5.7 Remedial Goal Options**

No COCs were identified for Wetland W1, and as a result, no RGOs were calculated.

#### **10.30.6 Conclusions and Recommendations**

Wetland W1 is a channelized drainage ditch without a viable aquatic community. In addition, this wetland is not considered a significant source of food or habitat. Therefore, as proposed in the approved RI/FS SAP Addendum, (EnSafe, 1997), this wetland was eliminated for further risk characterization. Since no COCs were identified for Wetland W1, no RGOs were calculated. Because no ecological or human health risks are present at Wetland W1, no further action is recommended for this wetland.

*Final Remedial Investigation Report*  
*NAS Pensacola Site 4I*  
*Section 10: Site-Specific Evaluations*  
*August 31, 2000*

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**Table 10-30-8**  
**Lead Model (Version 0.99d) Inputs and Results**  
**NAS Pensacola, Wetland W1**  
**Pensacola, Florida**

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100  $\mu\text{g Pb}/\text{m}^3$  DEFAULT  
 Indoor AIR Pb Conc: 30.0 percent of outdoor.  
 Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate ( $\text{m}^3/\text{day}$ )	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00  $\mu\text{g Pb}/\text{L}$  DEFAULT  
 WATER Consumption: DEFAULT

SOIL & DUST:

Soil: constant conc.  
 Dust: constant conc.

Age	Soil ( $\mu\text{g Pb}/\text{g}$ )	House Dust ( $\mu\text{g Pb}/\text{g}$ )
0-1	200.0	200.0
1-2	200.0	200.0
2-3	200.0	200.0
3-4	200.0	200.0
4-5	200.0	200.0
5-6	200.0	200.0
6-7	200.0	200.0

Additional Dust Sources: None DEFAULT

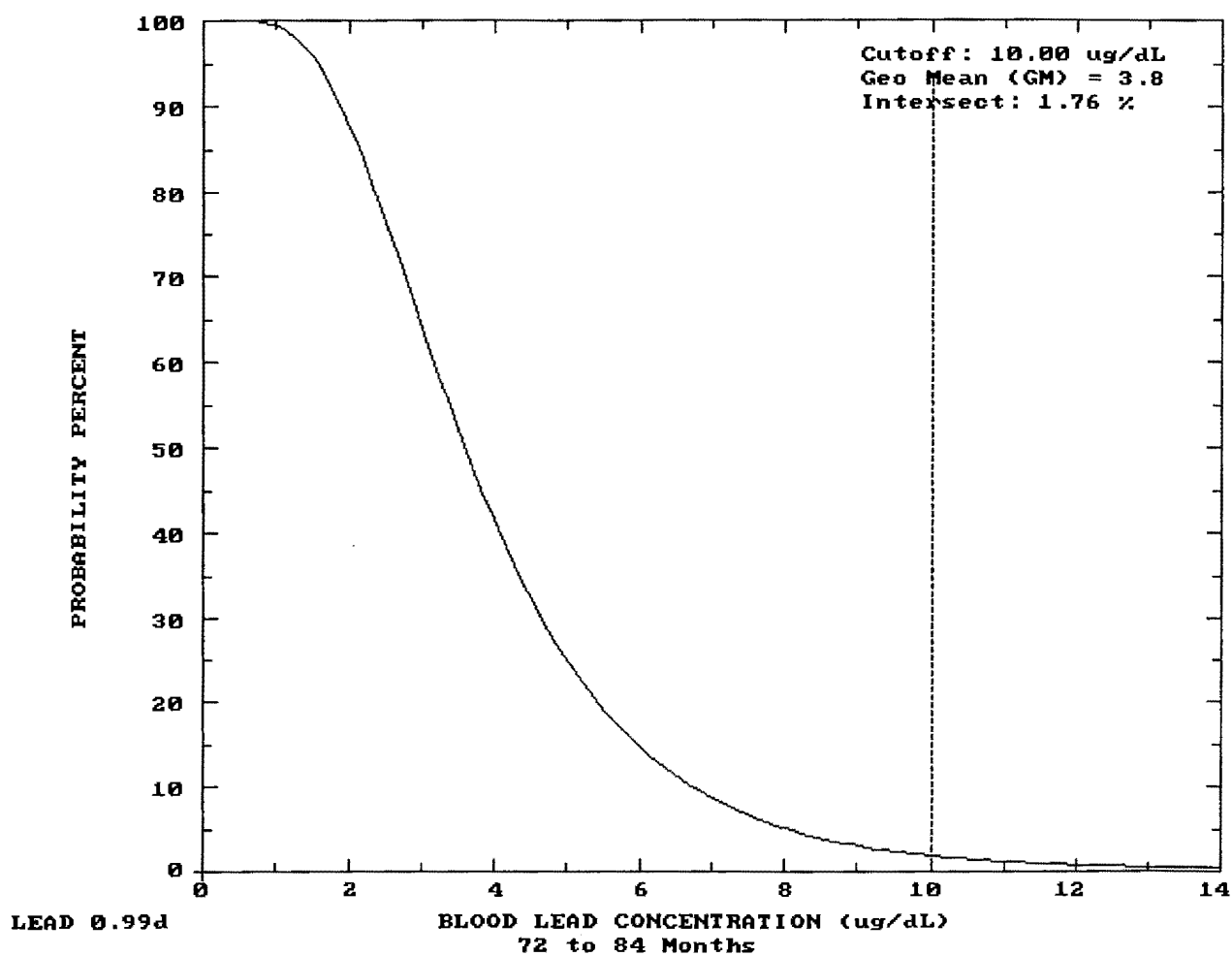
Alternative Source Intake: Wetland W1 sediment and surface water  
 6-7: 13.90  $\mu\text{g Pb}/\text{day}$

MATERNAL CONTRIBUTION: Infant Model  
 Maternal Blood Conc: 2.50  $\mu\text{g Pb}/\text{dL}$

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level ( $\mu\text{g}/\text{dL}$ )	Total Uptake ( $\mu\text{g}/\text{day}$ )	Soil+Dust Uptake ( $\mu\text{g}/\text{day}$ )	Diet Uptake ( $\mu\text{g}/\text{day}$ )	Water Uptake ( $\mu\text{g}/\text{day}$ )	Alt. Source Uptake ( $\mu\text{g}/\text{day}$ )	Air Uptake ( $\mu\text{g}/\text{day}$ )
0.5-1:	4.1	7.60	4.68	2.54	0.37	0.00	0.02
1-2:	4.5	10.93	7.36	2.63	0.91	0.00	0.03
2-3:	4.2	11.44	7.44	2.98	0.96	0.00	0.06
3-4:	4.0	11.48	7.53	2.90	0.99	0.00	0.07
4-5:	3.4	9.65	5.69	2.85	1.04	0.00	0.07
5-6:	3.0	9.39	5.16	3.03	1.11	0.00	0.09
6-7:	3.8	15.69	4.76	3.26	1.10	6.48	0.09

Figure 10-30-2 Probability Percentage of Blood Lead Levels for the Hypothetical Child Receptor



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## **10.31 WETLAND 75**

### **10.31.1 Site Description**

Wetland 75 is located north of Radford Road, near the western entrance to NAS Pensacola. Parsons and Pruitt (USEPA, 1991) described this area as a palustrine emergent wetland. Emergent vegetation, such as cattails (*Typha latifolia*), and lizard's tail (*Saururus cernis*) are found in this wetland. No IR sites exist in the vicinity of Wetland 75.

### **10.31.2 Nature and Extent**

The methods for evaluating nature and extent are presented in Section 6. Figure 10-31-1 denotes the Phase IIB/III Wetland 75 sampling locations. Wetland 75 was not sampled during the Phase IIA portion of the Site 41 field investigation.

### **Sediment**

Sixteen metals were detected in the single Wetland 75 sediment sample. No metals exceeded sediment benchmark levels at Wetland 75. Four pesticides were detected at Wetland 75, including 4,4-DDD, 4,4-DDE, 4,4'-DDT, and gamma-BHC. Although 4,4'-DDD (8.3 ppb), 4,4-DDE (5.7 ppb), and 4,4-DDT (2 ppb) concentrations exceeded benchmark levels, they were below basewide levels. Basewide levels are described in Section 6. Gamma-BHC (2.5 ppb) exceeded its sediment benchmark level (0.32 ppb). No PCBs were detected in the Wetland 75 sediment sample. The SVOC 3/4-methylphenol was detected in the Wetland 75 sediment sample; no sediment benchmark value exists for 3/4-methylphenol. The VOC acetone was detected in the Wetland 75 sediment sample; no sediment benchmark value exists for acetone. Table 10-31-1 shows the Wetland 75 Phase IIB/III sediment sample results (frequency of detection, range of detected concentrations, and average detected concentration).



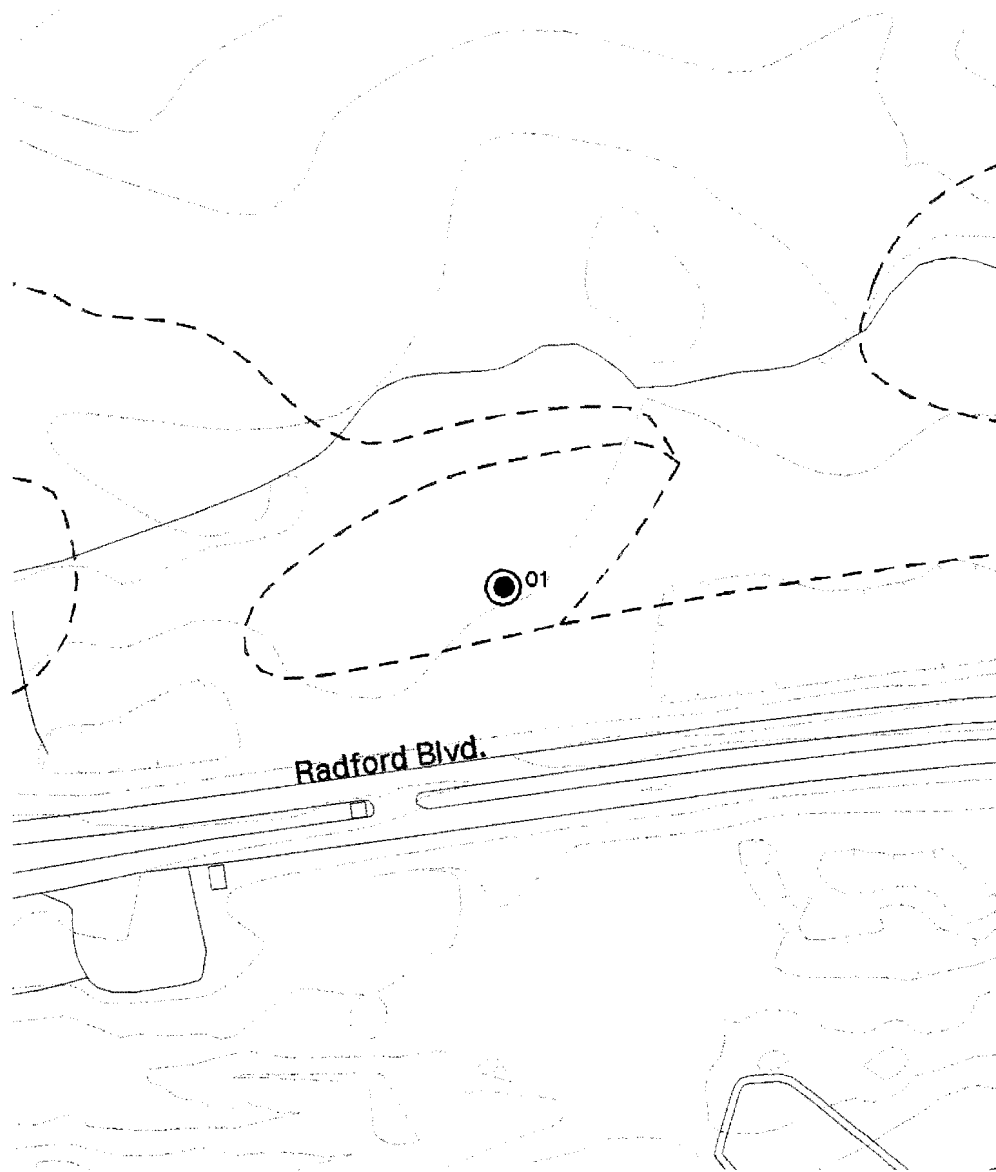
Table 10-31-1  
 Phase IIB/III Detected Concentrations in Wetland 75 Sediments

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (mg/kg)</b>			
Aluminum	1/1	1350	1350
Barium	1/1	4	4
Calcium	1/1	1300	1300
Chromium	1/1	2.1	2.1
Copper	1/1	0.82	0.82
Iron	1/1	681	681
Lead	1/1	6.5	6.5
Magnesium	1/1	100	100
Manganese	1/1	4.4	4.4
Mercury	1/1	0.04	0.04
Nickel	1/1	0.49	0.49
Potassium	1/1	27.9	27.9
Selenium	1/1	1	1
Sodium	1/1	30.2	30.2
Vanadium	1/1	2	2
Zinc	1/1	17.5	17.5
<b>Pesticides (µg/kg)</b>			
4,4'-DDD	1/1	8.3	9.15
4,4'-DDE	1/1	5.7	6.05
4,4'-DDT	1/1	2	1.75
gamma-BHC (Lindane)	1/1	2.5	2.3
<b>SVOCs (µg/kg)</b>			
3/4-Methylphenol	1/1	22	22
<b>VOCs (µg/kg)</b>			
Acetone	1/1	16	16

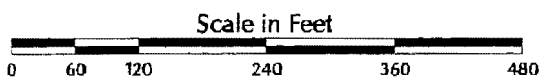
**Note:**

All results for inorganics are given in milligrams per kilogram (mg/kg), pesticides, PCBs, SVOCs and VOCs are given in micrograms per kilograms (µg/kg)

Table 10-31-2 compares detected concentrations at each sample location to sediment benchmark levels, and lists calculated HQs for each parameter. Only the detected parameters are presented on Table 10-31-2. The HQs will be further discussed in the ecological risk section.



- Sediment Sample Location
- Surface Water Sample Collected
- - Approximate Wetland Boundary



NAS Pensacola  
Site 41 - NAS Pensacola Wetlands  
Remedial Investigation

FIGURE 10-31-1  
PHASE IIB WETLAND 75  
SAMPLING LOCATIONS

Table 10-31-2 (1)

**Wetland 75****Phase IIB/III Sediment Concentrations Compared to Benchmark Levels**

Sample Location	Parameter	Detected Concentration	Sediment Benchmark Value (SBV)	HQ	SBV - HQ Reference
<b>041M750101</b>					
	4,4'-DDD (UG/KG)	8.3	1.22	6.80	b
	4,4'-DDE (UG/KG)	5.7	2.07	2.75	b
	4,4'-DDT (UG/KG)	2	1.19	1.68	b
	Chromium (MG/KG)	2.1	52.3	0.04	a b
	Copper (MG/KG)	0.82	18.7	0.04	a b
	gamma-BHC (Lindane) (UG/KG)	2.5	0.32	7.81	b
	Lead (MG/KG)	6.5	30.2	0.22	a b
	Mercury (MG/KG)	0.04	0.13	0.31	a b
	Nickel (MG/KG)	0.49	15.9	0.03	a b
	Zinc (MG/KG)	17.5	124	0.14	a b

## Notes:

(a) USEPA Screening Concentration for Sediment - EPA SSVs

(b) FDEP Sediment Quality Assessment Guidelines - FDEP SQAGs

Some of the numbers in the table may vary because of rounding.

## Surface Water

Ten metals were detected in the single Wetland 75 surface water sample. Aluminum (355 ppb), and iron (1,490 ppb) exceeded surface water quality criteria at Wetland 75. The pesticide dieldrin (0.0031 ppb) was detected above its surface water quality criteria of 0.0019 ppb.

Table 10-31-3 shows the Wetland 75 Phase IIB/III surface water sample results (frequency of detection, range of detected concentrations, and average detected concentration). Table 10-31-4 compares detected concentrations at each sample location to surface water quality criteria and lists calculated HQs for each parameter. Only the detected parameters with water quality criteria are presented in Table 10-31-4. The HQs will be further discussed in the ecological risk section.

Table 10-31-3  
 Phase IIB/III Detected Concentrations in Wetland 75 Surface Water

Parameter	Frequency of Detection	Range of Detected Concentrations	Average Detected Concentration
<b>Inorganics (µg/L)</b>			
Aluminum	1/1	355	355
Barium	1/1	5.2	5.2
Calcium	1/1	6960	6960
Iron	1/1	1490	1490
Magnesium	1/1	1560	1560
Manganese	1/1	34.9	34.9
Potassium	1/1	1790	1790
Sodium	1/1	12400	12400
Vanadium	1/1	1.8	1.8
Zinc	1/1	5.8	5.8
<b>Pesticides (µg/L)</b>			
Dieldrin	1/1	0.0031	0.0031

**Note:**

All results are given in micrograms per liter (µg/L) or parts per billion (ppb).

Table 10-31-4 (1)

**Wetland 75****Phase IIB/III Surface Water Concentrations Compared to Water Quality Criteria**

Sample Location	Parameter	UOM	Detected Concentration	Water Quality Criteria	HQ	Criteria Reference
<b>041W750101</b>	<b>Freshwater</b>					
	Aluminum	UG/L	355.00	87.00	4.08	a
	Dieldrin	UG/L	0.00	0.00	1.63	a b
	Iron	UG/L	1490.00	1000.00	1.49	a b
	Zinc	UG/L	5.80	70.20	0.08	a b

**Notes:**

(a) USEPA Water Quality Criteria (1995)

(b) FDEP Class III Water Quality Criteria (1996)

Some of the numbers in the table may vary because of rounding.

### 10.31.3 Fate and Transport

The pathways evaluated for the wetland specific fate and transport correlate to those identified in the conceptual model presented in Section 9. These pathways include: surface water/sediment transport into the wetland; groundwater discharge into the wetland; sediment/surface water transport within the wetland; sediment leaching to surface water within the wetland; and surface water/sediment transport from the wetland. Surface water, sediment transport and storm water runoff data are lacking; thus the evaluation is qualitative in nature. The method of evaluation of the leaching from sediment to surface water was presented in Section 9. Table 10-31-5 presents those contaminants present in sediment above benchmark levels (DDT and metabolites DDE and DDD, and gamma BHC) and their calculated SSLs. Table 10-31-4 previously presented those constituents detected in surface water above applicable surface water criteria (dieldrin, aluminum, and iron).

Table 10-31-5  
 Calculated Sediment Screening Values for Wetland 75  
 NAS Pensacola Site 41

Parameter	USEPA or FDEP Surface Water Standard	Kd	SSL DF = 100	Maximum Concentration Detected	Leaching Potential DF = 100
Organics (ppb)	(ppb)		(ppb)	(ppb)	
4,4'- DDD	0.0064 <sup>a</sup>	4.2E+04	2.7E+04	8.3	NO
4,4'- DDT	0.001 <sup>a, b</sup>	1.1E+05	1.10E+04	2	NO
4,4'- DDE	10.5 <sup>a, b</sup>	1.9E+05	2.0E+08	5.7	NO
gamma BHC	0.016 <sup>a, b</sup>	4.5E+E01	72	2.5	NO

**Notes:**

Kd for organics calculated using foc of 0.042 (numerical average of all sediment samples).

Kds/Kocs are from: USEPA, 1996 (first preference); Superfund Chemical Data Matrix, 1996 (second preference); Texas Risk Reduction Program Concept Document 2, Volume 1, Appendix VII, 1996 (third preference); TERRA Model, Oak Ridge National Laboratory, 1984 (fourth preference) — primary reference for inorganics).

Kd = normalized partitioning coefficient

SSL = sediment screening level

DF = dilution factor

<sup>a</sup> = USEPA Freshwater Surface Water Chronic Screening Value (1995b).

<sup>b</sup> = FDEP Class III Water Quality Criteria (1996).

## **Transport Into the Wetland**

### *Surface Water/Sediment Pathway*

Based on landform and watershed analysis, the following sources could have contributed contamination to Wetland 75 through this pathway:

Potential storm water runoff and sediment entrainment from the barge reloading dock, and from the highway surface bordering the southern boundary of the base with Pensacola Bay. Wetland 75 is significantly removed from known IR and UST sites at NASP, therefore it is unlikely that any of these have impacted the wetland. Given its proximity to the bay, and to its potential connection to Wetland 48, some backflushing to Wetland 75 can be expected during storm surge periods. At these times, sources potentially affecting Wetland 48 may also impact Wetland 75 via this pathway.

The presence of sediment contaminants above benchmark levels and surface water constituents above applicable criteria would appear to validate the sediment transport pathway, except that landform analysis indicates that the wetland is somewhat self-enclosed, particularly at its presumably upper (western) reach. Given the lack of a clearly defined pathway for surface water and sediment inflow to the wetland, and that the constituents above benchmark levels are all pesticides, it is likely that impacts may be residual from airborne pesticide application. If this is the case, then the pathway with respect to this wetland is considered invalid except during periods of backflushing.

### *Groundwater Discharge Pathway*

Based on potentiometric analysis (flow from the west) and the wetlands location at the western perimeter of the base, there are no known sources that can contribute contamination to this wetland.

## **Transport Within the Wetland**

### *Surface Water/Sediment Migration Pathway*

The configuration of wetland, along with landform analysis, indicates that the wetland is self-enclosed, and does not feed another drainage pathway under normal circumstances. Therefore, sediment contamination can be expected to remain within the wetland, and impetus for movement within the wetland influenced only by the direction(s) of storm water influx.

### *Sediment Leaching to Surface Water Pathway*

None of the constituents above a benchmark level exceeded their calculated SSL. Therefore, this pathway is considered invalid.

## **Transport From Wetland**

Physiographic analysis suggests that the wetland is self-enclosed, and under normal circumstances is not directly connected to another feature via direct surface water drainage. Therefore it is likely that sediment contamination will remain within the wetland, and this pathway is considered invalid.

### **10.31.4 Ecological Risk Assessment**

HQs for Wetland 75 sediment samples are presented in Table 10-31-2. Phase IIB/III sediment sample results compared to the appropriate sediment benchmark levels revealed HQs above 1 for 4,4'-DDD (6.8), 4,4'-DDE (2.75), and 4,4'-DDT (1.68) at the single Wetland 75 sample location. However, as noted in the Nature and Extent discussion, these 4,4'-DDD, 4,4'-DDE and 4,4'-DDT concentrations were below basewide levels. Gamma-BHC also had an HQ of 7.81. Phase IIB/III results of the single Wetland 75 surface water sample revealed HQs above 1 for aluminum (87), and iron (1.49). HQs greater than one indicate the potential for excess risk.



## Ecological Risk Evaluation

Risk in Wetland 75 was evaluated with respect to three assessment endpoints :1)piscivorous bird health and reproduction, 2)survival, growth and reproduction of macroinvertebrates associated with the benthic environment, and 3) protection of fish viability.

### Piscivorous Bird Health and Reproduction:

The results of this model, as shown in Table 10-31-6, estimate an excess risk posed by total DDT in fish tissue collected at 75-01. PCBs were not detected in the prey fish. The HQ estimated for heron exposure to total DDT in fish tissues from this sampling location is 15.59. Assuming that Wetland 75 is approximately 2 acres in size, an SFF of 0.06 was calculated based on the range of the heron described in Section 7. Using the SFF results in a PDE of 0.003 (mg/kg-day). An HQ of 1 is then calculated. Therefore, this wetland is considered acceptable for this assessment endpoint.

Table 10-31-6  
 Great Blue Heron HQ Calculations  
 Wetland 75

SFF Value	Location	Parameter	Tissue Concentration <sup>1</sup> (mg/kg)	Sediment Concentration <sup>2</sup> (mg/kg)	PDE <sup>3</sup> (mg/kg-day)	NOAEL <sup>4</sup> (mg/kg-day)	LOAEL (mg/kg-day)	HQ <sup>5</sup>
1	75-01	total DDT	0.260	0.06	0.047	0.003	0.028	15.59
0.06	75-01	total DDT	0.260	0.06	0.003	0.003	0.028	1

**Notes:**

- 1 = Whole body killifish or pinfish (wet weight).
- 2 = Samples from top 5 cm of sediment (wet weight).
- 3 = Potential Dietary Exposure: revised from model in SAP (E/A&H, 1997).
- 4 = Effects Levels in Sample *et al.*, 1996.
- 5 = Hazard Quotient = (PDE)÷(NOAEL).
- ND = Not detected.
- NOAEL = No-observed-adverse-effects-level.
- LOAEL = Lowest-observed-adverse-effects-level.

### Protection of Fish Viability:

Protection of fish viability was evaluated using three lines of evidence for Wetland 75 including 1) direct comparison of detected concentrations in fish tissue, 2) comparison of surface water detected concentrations to water quality criteria, and 3) toxicity analysis.

The first line of evidence, a direct comparison of tissue residue concentrations to toxic effects thresholds in Level 3 fish, shows that DDD, DDE and the calculated mercury concentration have HQs above 1. HQs above 1 indicate the potential for excess risk. The calculated mercury concentration is derived from the model contained in Appendix G. The concentration shown in Table 10-31-7 is from the mean sediment concentration of mercury in all the Site 41 Wetlands. The mercury concentration detected in Wetland 75 (0.04 mg/kg) is approximately one-third that value (0.14 mg/kg). Risk to Level 4 fish were not evaluated because as a small isolated freshwater wetland, Wetland 75 does not support Level 4 fish.

Table 10-31-7  
Contaminant HQ Calculations from Fish Tissue Samples  
Wetland 75

Constituent	Maximum Level 3 Fish Tissue Conc ( $\mu\text{g/kg}$ )	Level 3 Fish Tissue Conc. ( $\text{mg/kg}$ )	Screening Ecotoxicity Values ( $\text{mg/kg}$ )	HQ
4,4-DDD	110	0.110	0.10 <sup>1</sup>	1.1
4,4-DDE	150	0.150	0.10 <sup>1</sup>	1.5
Mercury*	—	0.168*	0.093 <sup>2</sup>	1.8

*Notes:*

Available: <http://www.wes.army.mil/el/t2dbase.html>

1 0.10 mg/kg NOED for mortality in the spiny dogfish, from Guarino, A.M. and S.T. Arnold (1979).

2 0.093 mg/kg NOED for mortality in the spiny dogfish, from Guarino, A.M. and S.T. Arnold (1979).

The mercury concentration for the Level 3 fish is calculated from the mean concentration of mercury in sediment for all the Site 41 Wetlands (Appendix G). The detected concentration of mercury in Wetland 75 sediment is 0.04 mg/kg, which is approximately one-third the mean concentration of 0.14 mg/kg).

### Surface Water Chemistry

As stated in Section 10.31.2, surface water analytical results for Wetland 75 exceeded applicable water quality criteria for aluminum, iron, and the pesticide dieldrin. Application of surface water

chemistry results to the decision making matrix revealed a matrix score of “+” for surface water chemistry.

### Toxicity in Surface Water

A chronic fathead minnow bioassay was also conducted at Wetland 75. The endpoints for this test were survival and growth, which is measured by weight. As with the sediment evaluation, the laboratory included a negative control by which to measure test performance, and to determine if the test meets acceptability criteria.

Survival results are presented in Table 10-31-8. As can be seen in the table, survival results for the fathead minnow tests were 90% for surface waters from Wetland 75.

Table 10-31-8  
Fathead Minnow Chronic Bioassay Results  
Wetland 75 Surface Waters

Site	% Survival	Weight (mg)	Matrix Scoring
Control (negative)	100	0.58	
Wetland 75	90	0.44*	—

*Notes:*

\* = Statistically significant difference from control population.

Application of these results to the matrix revealed a matrix score of “—” for the fathead minnow test. Table 10-31-9 presents the interpretation of the matrix analysis for the Wetland 75 surface water sample. Based on the results of the chemistry and toxicity data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Surface Water, as discussed in Figure 7-3.

Table 10-31-9  
 Matrix Analysis Interpretation  
 Wetland 75 Surface Water

Site	Water Chemistry	Toxicity Test	Interpretation
Wetland 75	+	—	Contaminants are not bioavailable.

Condition number 3 denotes that Wetland 75 sediment is acceptable and no further action is recommended for surface water for this wetland.

### Survival and Growth of Macroinvertebrates Associated with the Benthic Environment:

As discussed in Section 7, this assessment endpoint was evaluated using the sediment quality triad approach for chemistry, toxicity, and diversity analysis. Results are scored via the decision making triad, and the overall condition of the wetland for this assessment endpoint is determined.

### Sediment Chemistry

Table 10-31-2 compares detected Phase IIB/III sediment concentrations to benchmark levels and lists calculated HQs for each parameter. As stated in Section 10.31.2, sediment analytical results for Wetland 75 exceeded sediment benchmark levels for gamma-BHC. Application of sediment chemistry results to the decision making triad discussed in Section 7.14 revealed a matrix score of “+” for sediment chemistry.

### Sediment Toxicity

Sediment was collected at Wetland 75 for a chronic chironomid, *Chironomus tentans*, bioassay. The endpoints for this bioassay include survival, growth (which is measured by weight), and emergence. Chironomids are midges, small winged insects which spend the first portion of their lives developing in water as a larvae. A sub-lethal endpoint for this test is the emergence of adults from their larval state in water to becoming airborne and terrestrial.

The laboratory included a negative control by which to measure test performance. The negative control is expected to perform well and is one gauge in determining if a test can be deemed valid. The performance of the organisms in the negative control will determine if the test meets acceptability criteria. The negative control is also the only constant by which to gauge performance of the organisms, since solutions to be tested may have unknown characteristics.

Survival results in the *Chironomus tentans* test were 83% for sediments from Wetland 75, as presented in Table 10-31-10. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the chironomid test.

Table 10-31-10  
 Toxicity Test Results  
 Wetland 75 Sediment

Site	% Survival	Weight (mg)	Emergence	Triad Matrix Scoring
Control (negative)	91	2.7	50%	
Wetland 75	83	1.3*	50%	—

Note:

\* = Statistically significant difference from control population.

### Benthic Diversity in Sediment

Sediment samples were also sorted for benthic diversity. A species diversity of 2.50 was calculated for the Wetland 75 sediment sample. A total of eight organisms representing six species were collected at this location. Benthic diversity results and application to the triad matrix are presented in Table 10-31-11. Application of these results to the decision making triad discussed Section 7.14 revealed a triad matrix score of “—” for the benthic diversity test.

Table 10-31-11  
 Benthic Diversity Results and Application to the Triad Matrix  
 Wetland 75 Sediment

Site	Shannon-Weiner Diversity	Pielov's Evenness	Margalef's Richness	Triad Matrix Scoring
Wetland 75	2.5*	1.4*	5.52*	—

Note:

\* = Statistically significant difference from control population.

## Evaluation

Table 10-31-12 presents the interpretation of the triad analysis for Wetland 75. Based on the results of the chemistry, toxicity, and benthic assessment data, condition number 3 exists. This can now be applied to the Simplified Decision Flow Chart for Sediments, as discussed in Figure 7-2.

Table 10-31-12  
Triad Analysis Interpretation  
Wetland 75 Sediment

Site	Sediment Chemistry	Toxicity Test	Benthic Assessment	Interpretation
Wetland 75	+	—	—	Contaminants are not bioavailable.

Condition number 3 denotes that Wetland 75 sediments are acceptable and no further action is recommended for sediment for this wetland.

### 10.31.5 Wetland 75 Human Health Risk Assessment

#### 10.31.5 Wetland 75

Section 10.31.1 provides a detailed description of Wetland 75 and the area surrounding this wetland.

##### 10.31.5.1 Samples Included

###### Sediment

041M7501

###### Surface Water

041W7501

###### Fish Tissue

041J7501

#### **10.31.5.2 Current and Future Land Use**

Wetland 75 lies adjacent the easement along the north shoulder of Radford Road in an undeveloped portion of the base near the west gate entrance to NAS Pensacola. The wetland is fenced to the west and south, which restricts access to passersby. Though this area is accessible from the north by a dirt road, the wetland lies in a portion of the base where general access by the public is restricted. A lack of infrastructure near the site and its general proximity to Forrest Sherman Field may restrict the potential for future development of the area. The wetland does not support a recreational fishery.

#### **10.31.5.3 Fish Tissue COPCs**

Although prey fish samples were collected from this wetland, this pathway was not evaluated. As an isolated, freshwater wetland, this wetland does not support game fish.

#### **10.31.5.4 Sediment COPCs**

As shown in Table 10-31-13, no COPCs were identified.

#### **10.31.5.5 Surface Water COPCs**

As shown in Table 10-31-14, no COPCs were identified.

#### **10.31.5.6 Risk Summary**

No COPCs were identified following the screening comparisons described in Section 8 and presented above. As a result, no formal human health risk assessment was conducted for Wetland 75.

TABLE 10-31-13  
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN  
NAS PENSACOLA SITE 41

Scenario Timeframe: Current and Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: Wetland 75 Sediment

CAS Number	Chemical	(1) Minimum Concentration	(1) Minimum Qualifier	(1) Maximum Concentration	(1) Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	(3) Background Value	(4) Adolescent Site Trespasser PRG	(5) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(6) Rationale for Contaminant Deletion or Selection	
72548	4,4'-DDD	0.008		0.008		MG/KG	041M750101	1 / 1	NAV	0.008	0.008	N/A	92	57	C	N/A	NO	BSL
72559	4,4'-DDE	0.006		0.006		MG/KG	041M750101	1 / 1	NAV	0.006	0.006	N/A	65	41	C	N/A	NO	BSL
50293	4,4'-DDT	0.002	J	0.002	J	MG/KG	041M750101	1 / 1	NAV	0.002	0.002	N/A	65	41	C	N/A	NO	BSL
105445	4-Methylphenol	0.02	J	0.02	J	MG/KG	041M750101	1 / 1	NAV	0.02	0.02	N/A	1600	2500	N	N/A	NO	BSL
58899	gamma-BHC (Lindane)	0.003	J	0.003	J	MG/KG	041M750101	1 / 1	NAV	0.003	0.003	N/A	17	11	C	N/A	NO	BSL
67541	Acetone	0.016	J	0.016	J	MG/KG	041M750101	1 / 1	NAV	0.016	0.016	N/A	32000	49000	N	N/A	NO	BSL
7429905	Aluminum (Al)	1350		1350		MG/KG	041M750101	1 / 1	NAV	1350	1350	N/A	320000	490000	N	N/A	NO	BSL
7440393	Berium (Ba)	4		4		MG/KG	041M750101	1 / 1	NAV	4	4	N/A	22000	34000	N	N/A	NO	BSL
7440702	Calcium (Ca)	1300		1300		MG/KG	041M750101	1 / 1	NAV	1300	1300	N/A	N/A	N/A	N	N/A	NO	EN
7440473	Chromium (Cr)	2.1		2.1		MG/KG	041M750101	1 / 1	NAV	2.1	2.1	N/A	1600	2500	N	N/A	NO	BSL
7440508	Copper (Cu)	0.8	J	0.8	J	MG/KG	041M750101	1 / 1	NAV	0.8	0.8	N/A	13000	20000	N	N/A	NO	BSL
7439896	Iron (Fe)	681		681		MG/KG	041M750101	1 / 1	NAV	681	681	N/A	N/A	N/A	N	N/A	NO	EN
7439921	Lead (Pb)	7		7		MG/KG	041M750101	1 / 1	NAV	7	7	N/A	400	400	N	OSWER	NO	BSL
7439954	Magnesium (Mg)	100		100		MG/KG	041M750101	1 / 1	NAV	100	100	N/A	N/A	N/A	N	N/A	NO	EN
7439955	Manganese (Mn)	4.4		4.4		MG/KG	041M750101	1 / 1	NAV	4.4	4.4	N/A	15000	23000	N	N/A	NO	BSL
7439976	Mercury (Hg)	0.04	J	0.04	J	MG/KG	041M750101	1 / 1	NAV	0.04	0.04	N/A	95	150	N	N/A	NO	BSL
7440020	Nickel (Ni)	0.5	J	0.5	J	MG/KG	041M750101	1 / 1	NAV	0.5	0.5	N/A	6300	9800	N	N/A	NO	BSL
7440097	Potassium (K)	27.9	J	27.9	J	MG/KG	041M750101	1 / 1	NAV	27.9	27.9	N/A	N/A	N/A	N	N/A	NO	EN
7782492	Selenium (Se)	1	J	1	J	MG/KG	041M750101	1 / 1	NAV	1	1	N/A	1600	2500	N	N/A	NO	EN
7440235	Sodium (Na)	30.2	J	30.2	J	MG/KG	041M750101	1 / 1	NAV	30.2	30.2	N/A	N/A	N/A	N	N/A	NO	EN
7440622	Vanadium (V)	2		2		MG/KG	041M750101	1 / 1	NAV	2	2	N/A	2200	3400	N	N/A	NO	BSL
7440666	Zinc (Zn)	17.5		17.5		MG/KG	041M750101	1 / 1	NAV	17.5	17.5	N/A	95000	150000	N	N/A	NO	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(3) Background values were not developed for this media.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) Residential soil RBCs presented in Region III Risk-Based Concentration Tables, (USEPA, 1999).

(6) Rationale Codes Selection Reason:

Deletion Reason:

Above Screening Levels (ASL)  
Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions Definitions:

N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

OSWER = Office of Solid Waste and Emergency Response

J = Estimated Value

C = Carcinogenic

N Noncarcinogenic



**TABLE 10-31-14**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**  
**NAS PENSACOLA SITE 41**

Scenario Timeframe: Current and Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: Wetland 75 Surface Water

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Mean	(2) Concentration Used for Screening	Background Value	(3) Adolescent Site Trespasser PRG	(4) Commercial Maintenance Worker PRG	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Selection
7429905	Aluminum (Al)	355		355		UG/L	041W750101	1 / 1	NAV	355	355	N/A	120000	250000	N	N/A	BSL
7440393	Barium (Ba)	5.2	J	5.2	J	UG/L	041W750101	1 / 1	NAV	5.2	5.2	N/A	8300	18000	N	N/A	BSL
7440702	Calcium (Ca)	6960		6960		UG/L	041W750101	1 / 1	NAV	6960	6960	N/A	N/A	N/A	N/A	NO	EN
7439896	Iron (Fe)	1490		1490		UG/L	041W750101	1 / 1	NAV	1490	1490	N/A	N/A	N/A	N/A	NO	EN
7439954	Magnesium (Mg)	1560		1560		UG/L	041W750101	1 / 1	NAV	1560	1560	N/A	N/A	N/A	N/A	NO	EN
7439965	Manganese (Mn)	35		35		UG/L	041W750101	1 / 1	NAV	35	35	N/A	2400	5000	N	N/A	BSL
7440097	Potassium (K)	1790		1790		UG/L	041W750101	1 / 1	NAV	1790	1790	N/A	N/A	N/A	N/A	NO	EN
7440235	Sodium (Na)	12400		12400		UG/L	041W750101	1 / 1	NAV	12400	12400	N/A	N/A	N/A	N/A	NO	EN
7440622	Vanadium (V)	1.8	J	1.8	J	UG/L	041W750101	1 / 1	NAV	1.8	1.8	N/A	830	1800	N	N/A	BSL
7440666	Zinc (Zn)	5.8	J	5.8	J	UG/L	041W750101	1 / 1	NAV	5.8	5.8	N/A	36000	76000	N	N/A	BSL
60571	Dieldrin	0.0031	J	0.0031	J	UG/L	041W750101	1 / 1	NAV	0.0031	0.0031	N/A	0.14	0.16	C	N/A	BSL

(1) Minimum/maximum detected concentration

(2) Maximum concentration used as screening value.

(4) PRGs for site trespasser scenario calculated based on equations and parameters presented in Section 8 of this report.

(5) PRGs for commercial maintenance worker scenario calculated based on equations and parameters presented in Section 8 of this report.

(6) Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
Deletion Reason: Below Screening Levels (BSL)  
Background Levels (BKG)  
No Toxicity Information (NTX)  
Essential Nutrient (EN)

Definitions: N/A = Not Applicable

NAV = Not Available

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

#### **10.31.6 Conclusions**

Decision making triad evaluations conducted during the ecological risk assessment for sediment and surface water revealed that sediment and surface water are acceptable for Wetland 75. The HHRA found no COPCs for sediment or surface water. Fish consumption was not evaluated because this wetland, an isolated freshwater, does not support game fish. No further action is recommended for this wetland, although it was determined not be acceptable as a reference wetland.

## **11.0 CONCLUSIONS AND RECOMMENDATIONS**

The objectives of the Site 41 RI were to identify the nature and extent of contamination in sediment and surface water for all wetlands listed in Groups A-E. The following section summarizes the findings of the RI and makes appropriate recommendations.

Table 11-1 summarizes the results of the sediment/surface water sampling, ecological risk assessments, and human health risk assessments for each wetland. The table: (1) lists each wetland by group; (2) denotes their color code; (3) lists the applicable Phase IIB/III ecological risk assessment endpoints studied at each wetland; (4) lists the HHRA findings based on Phase IIA sediment and surface water results; and (5) lists the recommendation for each wetland. A brief rundown of the findings are as follows:

- Group A. Wetland 64 is recommended for NFA under the IRP. Contaminants in this wetland are related to storm water runoff and spills of petroleum products, and should be addressed under the base storm water program and the State of Florida petroleum program.
- Group B. Wetlands 3 and 5A are recommended for NFA under the IRP. The ecological risks at these wetlands were found to be limited. Human health risks at these wetlands are considered to be low due to the restricted access to these areas by human trespassers.
- Group C. Wetlands 4D, 15, 16, 18, and 63A are recommended for NFA under the IRP. The ecological risks at these wetlands were found to be limited. The HHRAs at these wetlands found no COCs at Wetlands 16 and 63A. Arsenic was found to be a sediment and/or surface water COC at Wetlands 4D, 15, and 18. However, these wetlands are located in restricted areas of the base and are not used for recreational swimming. The human health risks associated with these wetlands are therefore considered to be low.

Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 11: Conclusions and Recommendations  
 August 31, 2000

Table 11-1  
 Conclusions and Recommendations  
 NAS Pensacola Site 41

Toxicity Results													
Group	Wetland	Amphipod Survival (%)		Neanthes Survival/Growth (%)		Minnow Survival/Growth (%)		Chironomid Survival/Growth/Emergence (%)		Shannon-Weiner Diversity Index	HHRA COCs	HHRA Risk Estimates	Recommendation
A	64	64-04	78*	64-04	100/94	NM	NM	64-04 = 2.424 64-05 = 3.300 64-06 = 2.635	Arsenic <sup>a</sup>	1.5E -6 <sup>ad</sup>	NFA <sup>1</sup>		
		64-05	96	64-05	96/85								
		64-06	74*	64-06	88/100								
B	5A	NM		NM		5A-04	100/85	5A-04	100/100/75	5A-04 = 2.560	Vinyl Chloride <sup>b</sup>	1.94E -6 <sup>ad</sup>	NFA
						5A-05 5A-06	100/74* 97.5/ 79*	5A-05	100/61.5*/50	5A-05 = 3.164			
								5A-06	83/108 <sup>a</sup> /75	5A-06 = 2.425			
B	3	NM		NM		03-01	97.5/85	03-02	83/107 <sup>a</sup> /60	3-02 = 2.243	Arsenic <sup>ab</sup>	2.9E -6 <sup>ad</sup>	NFA
								03-07	91/74*/70	3-07 = 1.921		8.8E-6 <sup>bd</sup>	
C	4D	Wetlands 16/18 sampled to represent the Group C Wetlands								Represented by Wetlands 16/18	Arsenic <sup>a</sup>	1.7E -6 <sup>ad</sup> 2.7E-6 <sup>ae</sup>	NFA
C	15	Wetlands 16/18 sampled to represent the Group C Wetlands								Represented by Wetlands 16/18	Arsenic <sup>ab</sup>	1.15E -5 <sup>ad</sup> 1.24E-5 <sup>bd</sup> 1.85E-5 <sup>ac</sup> 1.46E-5 <sup>bc</sup>	NFA
C	16	16-03	93	16-03	100/94	NM		16-03	93/94/NM	16-03 = 1.692	No COCs	No RGOs calculated	NFA
C	18 A/B	18-B1	100	18-B1	100/99	NM		NM		18-B1 = 2.362	Arsenic <sup>ab</sup>	6.9E -6 <sup>ad</sup>	NFA
		Wetlands 16/18 sampled to represent the Group C Wetlands								Represented by Wetlands 16/18	No COCs	No RGOs calculated	NFA
D	10A	Man-made drainage ditch with limited ecological receptors									No COCs—no formal HHRA		NFA
		Man-made drainage ditch with limited ecological receptors									No COCs—no formal HHRA		NFA
D	5B	Man-made drainage ditch with limited ecological receptors									Same as 5A		NFA
D	W1	Non-jurisdictional by FDEP									No COCs	No RGOs calculated	NFA

Table 11-1  
 Conclusions and Recommendations  
 NAS Pensacola Site 41

Toxicity Results									
Group	Wetland	Amphipod Survival (%)	Neanthes Survival/Growth (%)	Minnow Survival/Growth (%)	Chironomid Survival/Growth/Emergence (%)	Shannon-Weiner Diversity Index	HHRA COCs	HHRA Risk Estimates	Recommendation
			Man-made drainage ditch with limited ecological receptors				BEQs <sup>a</sup>	2.1E-6 <sup>ad</sup>	NFA
			Not a significant source of food, water, or habitat				No COPCs—no formal HHRA		NFA
			Not a significant source of food, water, or habitat				No COPCs—no formal HHRA		NFA
NA	12		Limited ecological receptors—not studied in Phase IIB/III				No COCs	No RGOs calculated	NFA <sup>2</sup>
NA	13		Man-made drainage ditch with limited ecological receptors				No COPCs—no formal HHRA		NFA
NA	14		Detected parameters generally below benchmark/reference levels				Arsenic <sup>b</sup>	2.4E-6 <sup>bd</sup>	NFA
NA	15		Detected parameters generally below benchmark/reference levels				No COCs	No RGOs calculated	NFA
NA	16		Contaminants not IR site related—not studied in Phase IIB/III				Arsenic <sup>ab</sup>	1.3E-6 <sup>ad</sup> 2.45E-5 <sup>bd</sup> 2E-6 <sup>ac</sup> 5.6E-5 <sup>bc</sup>	NFA
NA	51		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
NA	56		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
NA	57		Contaminants not IR site related—not studied in Phase IIB/III				No COCs	No RGOs calculated	NFA <sup>3</sup>
NA	58		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
NA	63J1		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
NA	72		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
NA	79		Wetland 79 was filled under a Corps of Engineers permit and no longer exists						NFA
NA	W2		Contaminants not IR site related—not studied in Phase IIB/III				No COPCs—no formal HHRA		NFA <sup>3</sup>
	25		Not studied in Phase IIB/III				Meth. Chloride <sup>a</sup>	1.6E-6 <sup>ad</sup>	Suitable reference wetland

Remedial Investigation Report  
 NAS Pensacola Site 41  
 Section 11: Conclusions and Recommendations  
 August 31, 2000

Table 11-1  
 Conclusions and Recommendations  
 NAS Pensacola Site 41

Toxicity Results											
Group	Wetland	Amphipod Survival (%)		Neanthes Survival/Growth (%)		Minnow Survival/Growth (%)	Chironomid Survival/Growth/Emergence (%)	Shannon-Weiner Diversity Index	HHRA COCs	HHRA Risk Estimates	Recommendation
Ref.	17					Not studied in Phase IIB/III			No COCs	No RGOs calculated	Suitable reference wetland
Ref.	62					Not studied in Phase IIB/III			No COCs—no formal HHRA		Suitable reference wetland
Ref.	33	33-01 33-02	92 96	33-01 33-02	92/ 126 <sup>a</sup> 100/ 119 <sup>a</sup>	NM	NM	5.46	Pest <sup>c</sup>	5E-8 <sup>c,f</sup>	Suitable reference wetland
NA	75	NM		NM		90/76*	83/48*/50	2.5	Pest <sup>c</sup>	No COCs	NFA

**Notes:**

Color of text under Group/Wetland denotes whether the wetland is coded Red, Orange, or Blue. Reference wetlands are colored green.

Toxicity results are shown as actual survival rates (%).

Growth (%) is calculated by comparing to the bioassay exposed organism to the control organism performance.

\* = Indicates a statistically significant difference from the control organism.

☆ = Indicates the organisms being tested out-performed the control organisms for this category.

BEQs = Benzo(a)pyrene Equivalents.

COC = Contaminant of Concern.

HHRA = Human Health Risk Assessment.

NA = Not Applicable.

NFA = No further action.

NM = Not measured.

a = Sediment pathway COC/risk estimate.

b = Surface water pathway COC/risk estimate.

c = Fish tissue COC/risk estimate.

d = Adolescent trespasser scenario.

e = Maintenance worker scenario.

f = Subsistence fishermen

1 = Wetland 64 is recommended for NFA under the IRP. Remedial activities at this wetland should be associated with the base storm water management program or the State of Florida petroleum program.

2 = Wetland 12 is referred to the FDEP's petroleum program, as documented in the September 19-20, 1996 Partnering Meeting Minutes.

3 = Wetlands are referred to the base because contaminants cannot be tied to an IR site.

- Group D. Wetlands 10A, 6, 5B, W1, and 1 are recommended for NFA under the IRP. These wetlands are man-made drainage ditches with limited ecological receptors. Also, Wetland W1 was declared non-jurisdictional by FDEP. Additionally, except for Wetland 1, the HHRA for these wetlands found no COPCs/COCs. Risk estimates were calculated for BEQs in sediment at Wetland 1. However, due to the restricted access to human trespassers, the human health risks are considered to be low at Wetland 1.
- Group E. Wetlands 48 and 49 are recommended for NFA under the IRP. Ecological risk assessment at these wetlands found no significant source of food, water or habitat for potential receptors. The HHRA for these wetlands found no COPCs.
- Wetland 12. Wetland 12 is a red-coded wetland that was not studied in Phase IIB/III because it has limited ecological receptors. The HHRA also found no COCs. However, potential impacts from the 1992 spill of petroleum contaminated bilge water into this wetland may still need to be addressed. As documented in the September 19-20, 1996 Partnering Meeting Minutes, Wetland 12 is referred to the State of Florida's petroleum program.
- Wetlands 13 and 17 are recommended for NFA under the IRP. Detected parameters were generally below benchmark/reference levels.
- Wetlands 19, 52, 56, 57, 58, 63B, 72, and W2 are recommended for NFA under the IRP. These wetlands are referred to the base because their contaminants cannot be tied to an IR site.
- Wetland 79. This wetland was an isolated, man-induced wetland at the south end of Site 6; an area used as construction debris landfill at the base. Under a Corps of Engineers

permit issued to the Navy, this landfill was expanded over Wetland 79 during the 1995 BRAC demolition at Chevalier Field. Although Wetland 79 has been filled, data from the former wetland is included in the Site 41 RI for completeness.

Blue-coded wetlands were evaluated during the September 25 and 26, 1996 Partnering Meeting. As presented in Table 11-1 the wetlands were either approved for no further action or were referred to the base because the contaminants could not be tied to an IR site.



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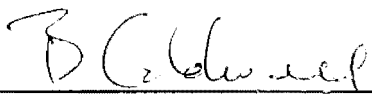
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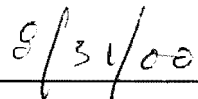


### **13.0 FLORIDA PROFESSIONAL GEOLOGIST SEAL**

I have read and approve of this Remedial Investigation Report, NAS Pensacola Site 41, and seal it in accordance with Chapter 492 of the Florida Statutes. In sealing this document, I certify the geological information contained in it is true to the best of my knowledge and the geological methods and procedures included herein are consistent with currently accepted geological practices.

Name: Brian Caldwell  
License Number: #1330  
State: Florida  
Expiration Date: July 31, 2002

  
\_\_\_\_\_  
Brian Caldwell

  
\_\_\_\_\_  
Date